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SPECIFICATIONS

PART A - DIVISION A1

NOTICE INVITING PROPOSALS

The Intermountain Power Service Corporation (IPSC) invites sealed bids for furnishing and delivering **up to eight (8) Induced Draft (ID) Fan Medium Voltage Frequency Drive (VFD) Systems** in accordance with **Specifications 45605**, available in the Purchasing Section, Intermountain Power Service Corporation (IPSC), 850 West Brush Wellman Road, Delta, Utah 84624-9546.

Proposals shall be submitted on IPSC's bidding forms. All Proposals shall be filed with the Buyer at the above address on or before **September 03, 2003.**

Each Proposal shall be accompanied by a certified or cashier's check payable to Intermountain Power Agency (IPA), or a Surety Bond payable to IPA, IPSC, and the City of Los Angeles Department of Water and Power (LADWP) in the amount of $50,000 as a guarantee that the bidder shall execute the proposed Contract Agreement if awarded.

Proposals shall be subject to acceptance within, and irrevocable for, a period of sixty (60) calendar days after date of bid opening.

IPSC reserves the right to reject any and all Proposals.

In the performance of any contract awarded, the bidder shall not discriminate in employment practices against any employee or applicant for employment because of race, religion, national origin, ancestry, sex, age, or physical disability.

Dated: _____

_____
John R. Larsen, Buyer
Intermountain Power Service Corporation

PART B - DIVISION B1

INSTRUCTIONS TO BIDDERS

1. Form, Signature, and Delivery of the Proposals: The bidder's Proposal shall be made on the yellow copy of the Bidding Documents. The Specifications printed on white paper shall be retained by the bidder.

   The bidder's name, address, and the date shall be stated in the Proposal. The Proposal shall be signed by the person authorized to bind the bidder.

   The Proposal shall be enclosed in a sealed envelope, plainly marked in the upper left-hand corner with the name and address of the bidder. The envelope shall bear the words "Proposal for," followed by the Specification Number, the title of the Specifications, and the date and hour of bid opening.

   If the Proposal is mailed, it shall be addressed as follows:

   Purchasing Section
   Intermountain Power Service Corporation
   850 West Brush Wellman Road
   Delta, UT 84624-9546

   If the Proposal is sent by messenger, it shall be delivered to the Administration Building, Intermountain Power Service Corporation, 850 West Brush Wellman Road, Delta, Utah.

2. Interpretations and Addenda: Should a bidder find discrepancies or omissions in the plans, specifications, or other documents, or should there be doubt as to their true meaning, the bidder shall submit to the Buyer a written request for an interpretation or clarification thereof. A request for addenda, interpretation, or clarification shall be delivered to the Buyer marked "Request for Interpretation" and must be received by the Buyer in time to permit a reasonable response before the date of opening bids. Any interpretation of, or change in the documents will be made only by addendum issued to each person to whom Specifications have been issued and will become a part of any contract awarded. IPSC will not be responsible for, or bound, by any other explanations or interpretations.

3. Correspondence: All inquiries or correspondence to IPSC prior to award of Contract shall be addressed to the Buyer.

4. Changes or Alternatives: The bidder shall not change any wording in the documents. Any explanations or alternatives offered shall be submitted in a letter attached to the front of the Bidding Documents. Alternatives which do not substantially comply with IPSC's Specifications cannot be considered. Language of negation or limitation of any rights, remedies, or warranties provided by law will not be considered part of the Proposal. Bids offered subject to conditions or limitations may be rejected.

5. Specified Materials or Equivalent: Whenever any particular material or process is specified by a patent or proprietary name, by a trade or brand name, of a manufacturer, such wording is used for the purpose of describing the material or process, fixing the standard of quality required, and shall be deemed to be followed by the words "or equivalent." The bidder may offer any material or process which shall be the equivalent of that so specified, but the bidder must identify the equivalent offered.

6. Language: Everything submitted by the bidder shall be written in the English language.

7. Sales or Use Taxes: Prices quoted by the bidder shall not include any applicable sales or use taxes or Federal Excise Taxes.

8. Duties: Prices quoted by the bidder shall include all applicable duties.

9. Award of Contract: Award of Contract will be made to the lowest and best, regular responsible bidder. The determination as to which is the lowest and best, regular responsible bidder may be made on the basis of the lowest ultimate cost of the services, materials, equipment, or other Work in place and use. The right is reserved to reject any or all Proposals.

   Within thirty (30) calendar days after the date of award of Contract, the successful bidder shall sign the Contract supplied by IPSC. The Contract will be effective upon execution by IPSC. Award of Contract is subject to execution of IPSC's form of Contract Agreement and other Contract Documents.

10. Comparison of Bids: For the purpose of comparing bids, it will be assumed that the quantity of **up to eight (8) Induced Fan Medium Voltage Variable Frequency Drive Systems** will be installed during the Contract period.

11. Bidder's Bond: The Proposal shall be accompanied by a certified check or a cashier's check issued by a responsible bank, payable in the state of Utah to the order of Intermountain Power Agency, in an amount not less than 10 percent of the aggregate sum of the Proposal. A surety bond payable to IPA, IPSC, and LADWP in a like amount will be accepted in lieu of a check.

12. Calculation of the Bonds: The estimated amount of the Proposal for the Bidder's Bond or of the Contract, will be considered to be the price, including freight charges, quoted by the bidder in the Proposal Schedule, times the assumed quantity under the Comparison of Bids in Article 10 of this Division.

PART B - DIVISION B2

SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

1. Quantities: The Proposal shall be based on furnishing eight (8) VFD Systems in accordance with the Proposal Schedule in Division C2, Bidding Documents; however, IPSC reserves the right to reduce the quantity of VFD Systems purchased. IPSC will notify the successful bidder by the option date listed in Division C2, of the total quantity of VFD Systems required.

2. Exceptions: Bidders should note that comparison of bids shall be based upon adherence to the these Specifications and cost. Any exceptions to these Specifications are to be specifically highlighted and noted on a separate sheet of paper and submitted with the Proposal. Strict attention to any material changes or exceptions to these Specifications or commercial terms and conditions shall be taken into consideration in the bid evaluation. IPSC reserves the right to reject any or all bids.

3. Pre-Bid Job Site Visits: The existing equipment space is extremely congested with limited access. Bidders desiring to visit the IPP Job Site to verify how the proposed equipment could be moved and fit into the final mounting locations, may do so by contacting John Larsen at (435) 864-6537.

PART C - DIVISION C1

BIDDING DOCUMENTS

BIDDER'S BOND

(Not necessary when certified or cashier's check accompanies bid. See below*.)

SURETY BOND

We, the undersigned Principal and Surety, acknowledge ourselves jointly and severally bound to Intermountain Power Agecy (IPA) and Intermountain Power Service Corporation (IPSC) of the state of Utah, and the City of Los Angeles Department of Water and Power (LADWP), in the sum of _____ Dollars ($_____), to be paid to IPA if the attached Proposal shall be accepted and the proposed Contract awarded to said bidder, and said bidder shall fail to execute the Contract and Bond for the faithful performance thereof; otherwise this obligation to be void.

Dated: _____, 20___

Firm Name: _____

_____

By: _____
(Signature)**

(Surety): _____

By: _____
(Signature)

*When the bidder is submitting a check in lieu of a Bond, the check must be made payable to Intermountain Power Agency, must either be certified by a responsible bank or be a cashier's check issued by a responsible bank, and must be payable in the state of Utah.

If check is submitted herewith, state check number _____ and amount $_____

**See Form, Signature, and Delivery of the Proposals, Division B1

NOTE: All signatures above must be written in ink.

PROPOSAL

The undersigned hereby proposes to furnish and deliver **up to eight (8) Induced Draft Fan Medium Voltage Variable Frequency Drive Systems** to the Intermountain Power Service Corporation in accordance with **Specifications 45605.**

The undersigned agrees, upon the acceptance of this Proposal: (a) To execute IPSC's form of Contract (including the Contract Agreement and other Contract Documents identified in said Specifications) for furnishing and delivering the items and services embraced in the accepted Proposal; and (b) To perform its obligations under the Contract at the prices stated in the accompanying Proposal Schedule.

The undersigned furthermore agrees that, in case of failure to execute such Contract Agreement and provide the necessary check or Bidder's Bond accompanying this Proposal, and the monies payable thereon, shall be forfeited to and remain the property of Intermountain Power Agency.

The undersigned declares under penalty of perjury that this Proposal is genuine, is not a sham or collusive, and is not made in the interest or in behalf of any person or entity not herein named. The undersigned further declares under penalty of perjury that the bidder has not directly or indirectly induced or solicited any other bidder to submit a sham bid, or any other person, firm, or corporation to refrain from bidding. The undersigned also declares under penalty of perjury that the bidder has not in any manner sought by collusion to secure for itself an advantage over any other bidder.

I declare under penalty of perjury under the laws of the state of Utah that the foregoing is true and correct.

Date: _____, 20_____

Bidder: _____

Address: _____

_____

Signed By: _____
(Authorized Signature)

Print Name: _____

Title: _____

PART C- DIVISION C2

BIDDING DOCUMENTS - PROPOSAL SCHEDULE

Proposal is hereby made to furnish and deliver to IPSC **up to eight (8) Induced Draft Fan Medium Voltage Variable Frequency Drive Systems**, F.O.B., IPP Plant Site, 850 West Brush Wellman Road, Delta, UT 84624, in accordance with **Specifications 45605**, the following:

Lump Sum Price For One (1) Complete Drive System For One (1) ID Fan Delivered In January 2004	
Price in Words: _____	Price in Dollars: $_____
Lump Sum Price For Two (2) Complete Drive Systems For Two (2) ID Fans Delivered In January 2005	
Price in Words: _____	Price in Dollars: $_____
Lump Sum Price For Three (3) Complete Drive Systems For Three (3) ID Fans Delivered In January 2006	
Price in Words: _____	Price in Dollars: $_____
Lump Sum Price For Two (2) Complete Drive Systems For Two (2) ID Fans Delivered In January 2007	
Price in Words: _____	Price in Dollars: $_____
Latest Date for IPSC To Exercise Option To Purchase Two (2) Complete Drive Systems In January 2005	
Date: _____	
Latest Date For IPSC To Exercise Option To Purchase Three (3) Complete Drive Systems In January 2006	
Date: _____	
Latest Date For IPSC To Exercise Option To Purchase Two (2) Complete Drive Systems in January 2007	
Date: _____	

****Note: Bids shall include an anticipated payment schedule.**

Contractor's Technical Services: The following adjuring prices will be used to adjust the Contract amount for manufacturer's service representatives time:

	Daily Rate	Daily Overtime Rate
Per Diem at the IPP Job Site:		
Per Round Trip to and from the IPP Job Site:		

Prices: The price or prices shall be firm.

Cash Terms: A discount for prompt payment is offered of _____ percent for Contract payments made within ____ calendar days after date of acceptance or delivery and receipt of invoice.

Taxes: The foregoing quoted prices are exclusive of all applicable sales and use taxes.

Manufacturer: _____

Location of Point of Manufacture: _____

Brand and Catalog Number or Other Designation: _____

Form of Business Organization: The bidder shall state below the form of its business organization.

Bidder is: _____, organized under the laws of the state of _____.
(Corporation, Partnership, Limited Partnership, Individual)

If a partnership, the bidder shall state below the names of the partners. If a corporation, the bidder shall state below the names of the president and of the secretary.

_____ _____

Person to Contact: Should IPSC desire information concerning this Proposal, please contact:

Name: _____ Telephone No: _____

Address: _____

(If different, the address of bidder's chief executive office is:) _____

_____

PART C - DIVISION C3

BIDDING DOCUMENTS - ADDITIONAL BID INFORMATION

1. Detailed Information: The bidder shall submit complete and definitive information on its offering in sufficient detail to permit a complete analysis of the Proposal. The requirements stated in the Instructions to Bidders, relative to information submittal, shall be followed.

   The requirements for information contained in this Division are basic requirements. Additional information shall be provided as requested by IPSC.

   The blank data sheets included in this Division shall be completely filled in. The data listed therein shall not relieve Contractor of its responsibility for meeting the requirements of the Detailed Specifications.

   The bidder shall not alter the original Proposal Data Division page numbers. If it becomes necessary to add pages, other than the end of the Division, a suffix such as a, b, c, etc., shall be added to the original number to designate the added page number. Pages added at the end of the Division shall be numbered sequentially by continuation of originally established numbering.

   Where alternates are indicated in the Proposal or Proposal Data, the bidder shall provide complete information for each alternate.

2. Drawings: Drawings shall be submitted with the Proposal in sufficient detail to permit evaluation of the equipment offered and to permit preliminary arrangement studies to be made.

   A plan view drawing showing the proposed equipment in the existing electrical equipment room shall be submitted. Contractor shall also include estimated weights for all equipment. Outdoor cooling equipment, if required, shall also be shown. External interconnection one-line diagram showing all power, control, and protection cabling required to complete the installation of the VFD systems.

3. Supplementary Information: The following supplementary information shall be submitted with the Proposal:

Supplementary Information
Complete Description of Proposed VFD. This Shall Include a Description of Shipping Components and Field Assembly Installation.
Summary Description of Codes and Standards Used If Different than Specified, Including a Review of Major Differences.

Supplementary Information
Identification of Any Modifications Required to IPSC's ID Fan System, Composed of ID Fan Motor, ID Fan, Connecting Shaft, Bearings, and Cable Connecting the ID Fan Motor to the VFD System to Allow this Equipment to Operate with the VFD While Maintaining a Normal Thirty (30) Year Lifetime of the ID Fan System.
Documentation Indicating Contractor's VFD System Does Not Produce Torsional Vibrations, Shaft Torsional Resonance, or Torque Pulsations Within the Connecting Shaft of the ID Fan System.
Documentation Indicating Contractor's VFD System Will Not Create Accelerated ID Fan System Bearing Wear Due to Common Mode Voltages Delivered by High Frequency PWM or Other Signals from Contractor's Inverter Drive.
Documentation Indicating Contractor's VFD System Does Not Contribute to Insulation Breakdown of the End Turns of the Motor Winding.
Names and Other Contact Information of Five (5) Purchasers of the Proposed VFD System Applied to Motors of 3,000 Horsepower (HP) and Above Who Have Had the Equipment Installed and Operating for at Least Two (2) Years.
Priced Preliminary Spare Parts List.
Input Current Including Harmonic Content at 25, 50, 75, 85, and 100 Percent Load.
Composite Data on Mean Time to Failure and Mean Time to Repair for Typical Components Contained Within the VFD System and Shown by Operating Experience to Fail or Require Replacement.
Detailed Description of the Installation Instructions of the Proposed Drive System Including All of Its Components and Any Modifications to Existing Equipment.
Description of the Failure Mode If Control Power Is Lost to the VFD Control System.
Description of VFD Operation When the Input Voltage Dips to 70 Percent.
Description of the Failure Modes of the Power Switching Devices (SCR, GTO, Diode, IGBT, IGCT, etc.), or Switching Device Control That Will Allow the Drive System to Continue to Operate Without Tripping the Fan.
Description of Accelerating and Decelerating Torque Programming Capabilities and Other Pertinent Capabilities and Limitations.
Preliminary Schedule.

Supplementary Information
Harmonic Calculation.
Efficiency (At the Input to VFD Isolation Transformer) Graph with Y-Axis Indicating 25, 50, 75, 85, and 100 Percent Torque and X-Axis Indicating 25, 50, 75, 85, and 100 Percent Frequency.
Catalog Brochures.
Complete List of Required Maintenance Tools as Discussed in Division F3, Article 15, General Equipment Specifications. The Listing Shall Include a Complete Description and Quantity of Each Item.
Information Specified in Division B1, Instructions to Bidders.
Equipment Storage Requirements, Including Inside or Outside Requirements and Requirements for Controlled Temperature or Humidity, etc.
Description of Manufacturing, Testing, and Inspection Procedures.
Written Description, Logic Diagrams, or Ladder Diagram Indicating Recommended Operating Sequence.
Maintenance Activities Required by the Manufacturer And/or by Contractor to Provide Adequate Storage and to Maintain Valid Material and Equipment Warranties.
Motor Information If Motor Is Furnished from Division F9, Medium Voltage Induction Motors.
Transformer Information Division F8, VFD Isolation (VFDI) Transformers

4. Equipment and Material Data: Please provide the following equipment and material data to assist IPSC in evaluating the Technical Proposal:

Equipment and Material Data
Complete Description of the Proposed System Indicating Exactly What Is Being Replaced and What Is Being Reused.
A Drawing (the Plant Arrangement - AQCS Control Building Mezzanine Drawing May Be Marked up to Show Equipment Layout) Showing the Proposed Arrangement and Dimensions Including Clearances Between Existing Items and All New Items. This Drawing Shall Also Indicate the Approximate Weight of All Components and Any New Wall or Floor Penetrations.

Equipment and Material Data
Guaranteed Reliability and Maintainability Times of the Proposed System.
Description of the Work Required for Complete Replacement.
A List of Maintenance Tools, Which Shall Be Furnished with the Equipment.
A Description of the Manufacturer's Standard Factory Test Procedure.
Expected and Maximum Heat Loss on a per Drive Basis.
A List of at Least Three (3) Sites and Names of Individuals That May Be Contacted Where Similar Equipment Has Been Retrofitted.
If a New Motor Is Being Provided, Verify That the Minimum Speed of 10 Percent Is Acceptable to the Motor Vendor.
Since the VFD Shall Be Suitable for Continuous Operation at Turning Gear Speed for Equipment Cool-down, Provide Information Describing the Operation at Turning Gear Speed.
Harmonic Analysis, Which Includes All Voltage and Current Harmonics up to the 49^{th}.
Any Alternate Access Options Required.
Heat Dissipation Data Necessary to Verify Adequacy of Existing HVAC System to Design a New HVAC System.
A Summary Description of Codes and Standards Used If Different than Specified Including a Review of Major Differences.
A Price List of Recommended Spare Parts.
A List of Any Special and Maintenance Tools Being Furnished.
Bidder's Experience Record with Proposed Equipment.
A List of Factory Routine Tests Being Proposed.
A Complete Description of the Extent of Shop Assembly of Components, and What Will Not Be Shop Assembled.
Efficiency Versus Load Curves Based on the Driven Equipment.

Equipment and Material Data
A Written Description of the Results of a Failure of Any Power Switching Device (SCR, GTO, Diode, IGBT, IGCT, etc.), or Switching Device Control. Contractor Shall Include the Sequence of Each Channel in the Write-up.
A Description of Why Rear or Side Access Is Needed.
Contractor Shall Confirm That All Power Components in the Converter Sections Will Be Mounted on a Swing Frame or Rack-out for Ease of Maintenance. If Not, Contractor Shall Describe Proposed Mounting Method.

Variable Frequency Drive System	
VFD Isolation Transformer Rating (kVA):	
System Input Voltage:	
System Output Voltage:	
Rated Drive Output Power (Continuous kVA):	
Rated Drive Output Current (Continuous A):	
Nominal Load Power (HP):	
Rated VFD Input Current (A):	
Nominal VFD Input Current at 8,200 HP Output (A):	
Variable Frequency Drive	
Manufacturer and Model:	
Overall Dimensions:	
Height (Inches):	
Depth (Inches):	
Width (Inches):	
Shipping Height (Inches):	
Length of Longest Shipping Piece (Inches):	
Technology:	
Microprocessor-Based Multi-Level Switching:	
Phase/Frequency/Voltage (ph/Hz/V):	
Rectifier Device:	
Inverter Device:	
Cell Voltage (V):	
Number of Cells:	

Variable Frequency Drive	
In the Event of Any Power Switching Device (SCR, GTO, Diode, IGBT, IGCT, etc.), Failure, Will the VFD Continue to Operate at Full Rated Output?	Yes _____ No _____
If "No", Explain:	
Number of Pulses:	
DC Link Capacitors:	Yes _____ No _____
Input Power Factor (30 to 100 Percent Speed) (Cos f):	
Power Interrupt Ride-Through Duration (Cycles):	
Voltage Dip (With Continuous Operation) (Percent):	
VFD Output Voltage (V):	
Overload Capability for Sixty (60) Seconds (Percent):	
Torque Pulsations Across Speed Range (Percent):	
Cooling Medium:	
Enclosure Protection:	
Ambient Temperature Maximum (°C):	
Humidity (Non-Condensing) (Percent):	
Altitude (Feet):	

DC Link Reactor Data	
Manufacturer:	
Class and Type of Core:	
Insulating Liquid:	
Quantity:	
Nominal DC Voltage Rating (V):	
Continuous DC Current Rating (V):	
Rated DC Load (kW):	
Conductor Material of Winding (If Aluminum, State Grade):	
Basic Lighting Impulse Insulation Level (BIL) (kV):	
Approximate Resistance at 75°C (OHM):	
Inductance (Henrys) (H):	
Loses (Guaranteed):	
No-Load Loss (Excitation Only):	
At 100 Percent Voltage (kW):	
At 110 Percent Voltage (kW):	
Total Loss, No-Load Loss Plus Load Loss, With Full Rated DC Load (kW):	
Temperature Under Continuous Operation Guaranteed:	
Temperature Rise at Full Rated DC Load:	
Winding Temperature Rise by Resistance (°C):	
Hottest Spot Winding Temperature Rise (°C):	
Average Sound Level at Rated DC Load, Scale "A", Slow Response, at One (1) Foot from Reactor (DC):	

DC Link Reactor Data	
Short Circuit Capability:	
DC Short Circuit Current (A):	
Maximum Duration of Short Circuit Current (Seconds):	
Weight and Dimensions:	
Net Weights:	
Core and Coils (Pound):	
Insulating Liquid (Pound/Gallon):	
Total (Pounds):	
Heaviest Piece to Handle During Erection (Pounds):	
Overall Dimensions:	
Height (Inches):	
Depth (Inches):	
Width (Inches):	
Shipping Height (Inches):	
Tuned Filter Bank	
Is a Tuned Filter Bank Required for Harmonic Suppression:	Yes _____ No _____
If "Yes", Where Is it Mounted? (Include Dimensions and Weights):	
Drive Cooling System	
Manufacturer:	
Cooling Methodology (Liquid/Air):	
Type of Liquid:	
Is Cooling System 100 Percent Redundant:	Yes _____ No _____
Net Weight (Pounds):	

Harmonic Voltage Distortion			
Guaranteed Maximum Harmonic Voltage Distortion Contribution, Without Filters, to Auxiliary Electrical Power System Under the Worst Case Conditions:			
Harmonic	**90 Percent**	**100 Percent**	**110 Percent**
5			
7			
11			
13			
17			
19			
23			
25			
Total:			

Efficiency	
Guaranteed Overall System Efficiency at Rated Speed and Load (Percent):	
Total Guaranteed System Losses at Rated Speed and Load (kW):	
System Speed Response	
Maximum Deceleration Rate (Rpm/Sec):	
Maximum Acceleration Rate (Rpm/Sec):	
Interface	
Type and Quantity of Communication Ports Which Are Included, (i.e., RS232, RS485, USB):	

PART D - DIVISION D1

CONTRACT DOCUMENTS DESCRIPTION

The Contract Agreement, together with the documents listed in Article 3 thereof, the Reference Specifications, any other documents listed below, and such of Contractor's Proposal documents as are expressly agreed to by IPSC shall constitute the Contract (the Contract). Said Documents are complementary and require complete and finished Work. Anything shown or required of Contractor in any one or more of said documents shall be as binding as if contained in all of said documents. Contractor shall not be allowed to take advantage of any error, discrepancy, omission, or ambiguity in any document, but shall immediately report to the President and Chief Operations Officer, in writing, any such matter discovered. The President and Chief Operations Officer will then decide or correct the same and the decision will be final.

PART E - DIVISION E1

GENERAL CONDITIONS

1. Definitions: The following words shall have the following meanings:

   a. Bidder: The person, firm, or corporation adopting and submitting a Proposal under these Specifications.

   b. Buyer: The Purchasing Agent for IPSC.

   c. Contract Administrator: The IPSC employee designated by the President and Chief Operations Officer with primary responsibility for administration of the Contract, or other representatives designated by the Contract Administrator acting within the limits of their authority.

   d. Contractor: The person, firm, or corporation to whom the Contract is awarded.

   e. Directed, Required, Approved, etc.: The words *directed, required, approved, permitted, ordered, designated, prescribed, instructed, acceptable, accepted, satisfactory,* or similar words shall refer to actions, expressions, and prerogatives of the Contract Administrator unless otherwise expressly stated.

   f. Gallon: Liquid volume of 231 cubic inches at 60 degrees Fahrenheit.

   g. IGS: Intermountain Generating Station located at 850 West Brush Wellman Road, Delta, Utah 84624.

   h. IPA: Intermountain Power Agency, the owner of Intermountain Power Project, and a political subdivision of the state of Utah, organized and existing under the Interlocal Co-operation Act, Title 11, Chapter 13, Utah Code Annotated 1953, as amended.

   i. IPP: Intermountain Power Project, consisting of Intermountain Generating Station, Intermountain Railcar, Intermountain Converter Station, Adelanto Converter Station, Intermountain AC Switchyard and associated transmission lines, microwave stations, and support facilities.

   j. IPSC: Intermountain Power Service Corporation, a nonprofit corporation, furnishing personnel to support the Operating Agent in the performance of operation and maintenance.

   k. Operating Agent, or LADWP: The City of Los Angeles Department of Water and Power which is responsible for operation and maintenance for IPP.

l. President and Chief Operations Officer: The President and Chief Operations Officer of IPSC, or other representatives designated by the President and Chief Operations Officer acting within the limits of their authority.

m. Reference Specifications: Those bulletins, standards, rules, methods of analysis or tests, codes, and specifications of other agencies, engineering societies, or industrial associations referred to in these Specifications. These refer to the latest edition, including amendments published and in effect at the date of the Invitation for Proposal, unless specifically referred to by edition, volume, or date. Unless the context otherwise requires, Reference Specifications also include all amendments published or adopted after the date of the Invitation for Proposal.

n. Subcontractor: A person, firm, or corporation, other than Contractor and employees thereof, who supplies labor, services or materials for a portion of the Work to be performed by Contractor under the Contract.

o. Ton: The short ton of 2,000 pounds.

p. Work: The services, materials, equipment, and other performance identified in these Specifications and other Contract Documents to be provided by Contractor.

2. Materials and Work: All Work shall comply with these Specifications. All materials used or supplied, and all equipment furnished, shall be new and unused, but this requirement shall not preclude the use of recycled materials in the manufacturing processes. All Work shall be done by qualified workers in a thorough and workmanlike manner that would pass without objection in both Contractor's trade and IPA's and IPSC's industry. Materials, equipment, workmanship, and other Work not definitely specified, but incidental to and necessary for the Work, shall conform to the best commercial practice for the type of Work in question and be of a quality that passes without objection in Contractor's trade and IPA's and IPSC's industry.

3. Nondiscrimination: The applicable provisions of Executive Order No. 11246 of September 24, 1965, and Bureau of Land Management regulations, and all other applicable governmental regulations pertaining to nondiscrimination in employment in the performance of contracts, are incorporated herein by reference, and made a part hereof as if they were fully set forth herein. During the performance of the Contract, Contractor shall not discriminate in its employment practices against any employee or applicant for employment because of the employee's or applicant's race, religion, national origin, ancestry, sex, age, or physical disability. All subcontracts awarded under or pursuant to the Contract shall contain a like nondiscrimination provision.

4. Governing Law; Venue: The Contract shall be governed by the substantive laws of the state of Utah, regardless of any rules on conflicts of laws or choice of law that would otherwise cause a court to apply the laws of any other state or jurisdiction. Any action, in law or in equity, concerning any alleged breach of or interpretation of the Contract, or concerning any tort in relation to the Contract or incidental to performance under the Contract, shall be filed only in the state or federal courts located in the state of Utah.

5. Patents and Intellectual Property: Contractor shall fully indemnify and, at the election of IPA, defend IPA, IPSC, and the Operating Agent against any and all liability, whatsoever, by reason of any alleged infringement of any intellectual property rights (including, but not limited to, patents, copyrights, trademarks, or trade secrets) on any article, process, method, or application used in any designs, plans, drawings, or specifications provided under the Contract, or by reason of Contractor's manner of performance under the Contract, or by reason of use by IPA, IPSC, or the Operating Agent of any article, process, or material specified by Contractor.

   All drawings, specifications, calculations, models, data, and other engineering documents (collectively "Drawings") shall be delivered to and be the property of IPSC. IPSC shall be entitled to use the Drawings and the information contained therein for the construction, operation, maintenance, repair, alteration, improvement, and expansion of IPP Facilities.

6. Contractor's Address and Legal Service: The address given in the Proposal shall be considered the legal address of Contractor and shall be changed only by advance written notice to IPSC. Contractor shall supply an address to which certified mail can be delivered. The delivery of any written communication to Contractor personally, or delivery to such address, or the depositing in the United States Mail, registered or certified with postage prepaid addressed to Contractor at such address, shall constitute a legal service thereof.

7. Assignment of Contract Prohibited: Contractor shall not assign or otherwise attempt to dispose of the Contract, or any rights hereunder, or of any monies due or to become due hereunder, unless authorized by the prior written consent of the President and Chief Operations Officer. The Contract, and Contractor's rights hereunder (including rights of collection) are nonassignable without the President and Chief Operations Officer's prior written consent. No right or claim can be asserted against IPA, IPSC, or the Operating Agent, in law or equity, by any person, by reason of any assignment or disposition unless so authorized.

   If Contractor, without such prior written consent, purports to assign or dispose of the Contract, or any right or interest hereunder, IPSC may at its option terminate the Contract. Such termination shall relieve and discharge IPA, IPSC, and the Operating Agent from any and all liability, duties, and obligations to Contractor, and to any assignee or transferee thereof.

8. Quality Assurance: IPSC has the right to subject any or all materials, services, equipment, or other Work furnished and delivered under the Contract to rigorous inspection and testing. (Unless otherwise specifically provided in the Contract with respect to specific materials, services, equipment, or other Work, IPSC has no duty to inspect, test, or specifically accept.) Before offering any material, services, equipment, or other Work for inspection, testing, delivery, or acceptance, Contractor shall eliminate all items or portions which are defective or do not meet the requirements of these Specifications. If any items or portions are found not to meet the requirements of these Specifications, the lot, or any faulty portion thereof, may be rejected. Only the Contract Administrator may accept any material, service, equipment, or other Work as complying with these Specifications on behalf of IPSC.

   IPSC may inspect and reject materials, services, equipment, or other Work tendered or purchased under the Contract at any reasonable location IPSC may choose (including, but not limited to, points of origin, while in transit to IPSC, IPSC specified receiving points, IPSC storage sites, or any point of use or installation). Inspection can include any testing that IPSC deems necessary or convenient to determine compliance with these Specifications. The expense of any initial tests will be borne by IPSC. All expenses of subsequent or additional tests will be charged against Contractor when due to failure of first-offered materials, services, equipment, or other Work to comply with these Specifications.

   The fact that the materials, services, equipment, or other Work have or have not been inspected, tested, or accepted by IPSC, whether voluntarily or as required by any specific provision in the Contract, shall not relieve Contractor of responsibility in case of later discovery of nonconformity, flaws, or defects, whether patent or latent.

9. Extra Work, Reduced Work, and Change Orders by IPSC: IPSC reserves the right at any time before final acceptance of the entire Work to order Contractor to furnish or perform extra Work, or to make changes altering, adding to, or deducting from the Work, without invalidating the Contract. Changes shall not be binding upon either IPSC or Contractor unless made in writing in accordance with this Article.

   Changes will originate with the President and Chief Operations Officer who will transmit to Contractor a written request for a Proposal covering the requested change, setting forth the changed Work in detail, and including any required supplemental plans or specifications. Upon receipt of such request, Contractor shall promptly submit in writing to the President and Chief Operations Officer a Proposal offering to perform such change, a request for any required extension of time caused by such change, and an itemized statement of the cost or credit for the proposed change. Failure of Contractor to include a request for extension of time in the Proposal shall constitute conclusive evidence that such extra Work or revisions will entail no delay and that no extension of time will be required.

If Contractor's Proposal is accepted by IPSC, a written change order will be issued by the President and Chief Operations Officer stating that the extra Work or change is authorized and granting any required adjustments of the Contract price and of time of completion. If Contractor's Proposal is rejected by IPSC, then IPSC may order the additional or changed Work from other vendors.

Additional Work or changes pursuant to the change order shall be performed in accordance with the terms and conditions of these Specifications. No extra Work shall be performed or change made unless pursuant to such written change order, and no claim for an addition to the Contract price shall be valid unless so ordered.

Notwithstanding anything in the preceding paragraphs to this Article, IPSC may issue a written order reducing the Scope of Work without issuing a request for Proposal. Any such reduction in the Scope of Work shall be effective upon issuance. Reductions ordered by IPSC shall constitute partial terminations and shall reduce the price to be paid.

10. Changes at Request of Contractor: Changes may be made to facilitate the Work of Contractor. Such changes may only be made without additional cost to IPSC, without extension of time, and pursuant to written permission from the President and Chief Operations Officer. Permission for such changes shall be requested in writing by Contractor to the President and Chief Operations Officer.

11. Time is of the Essence and Extensions of Time: Time is of the essence to the Contract. Delivery and other performance of Work must be completed within the times and by the dates specified. Time for delivery or other performance of Work shall not be extended except as provided in this Article. Failure to deliver or otherwise perform Work within the times and by the dates specified shall constitute a default and be grounds for IPSC to immediately terminate the Contract.

If Contractor makes a timely written request in accordance with this Article, the time for delivery or other performance of Work will be extended by a period of time equivalent to any delay in the whole Work which is: (a) Authorized in writing by the President and Chief Operations Officer; (b) Caused solely by IPSC; or (c) Due to unforeseeable causes (such as war, strikes, or natural disasters) and which delay is beyond the control and without the fault or negligence of Contractor and subcontractors.

Contractor shall promptly notify the President and Chief Operations Officer in writing at both the beginning and ending of any delay, of its cause, its effect on the whole Work, and the extension of time claimed. Failure of Contractor to provide such written notices and to show such facts shall constitute conclusive evidence that no excusable delay has occurred and that no extension of time is required.

The President and Chief Operations Officer will ascertain the facts and the extent of the delay and will extend the time for delivery when the findings of fact justify such an extension. The President and Chief Operations Officer's determination will be final and conclusive.

IPSC will be responsible for granting extensions of time as herein provided, but will not otherwise be responsible in any manner or liable to any extent for damage directly or indirectly suffered by Contractor as a result of any delay.

12. Protests and Claims: If Contractor considers any demand of the President and Chief Operations Officer to be outside of the requirements of the Contract, or considers any amount of payment, or any record, ruling, or other act, omission, or determination by the President and Chief Operations Officer to be unreasonable, Contractor shall promptly deliver to the President and Chief Operations Officer a written statement of the protest and of the amount of compensation or nature of accommodation, if any, claimed.

Upon written request by the President and Chief Operations Officer, Contractor shall provide access to all records containing any evidence relating to the protest or claim.

Upon review of the protest, claim, and evidence, the President and Chief Operations Officer will promptly advise Contractor in writing of the final decision which will be binding on all parties.

The requirements of this Article shall be in addition to, and shall not be construed as waiving claims provisions of the Statutes of the state of Utah. Contractor is deemed to have waived and does waive all claims for extensions of time and for compensation in addition to the Contract price except for protests and claims made and determined in accordance with this Article.

13. Limitation of Liability; Responsible Party: It is understood and agreed that IPA shall be the sole party or person liable to Contractor for payments under or pursuant to the Contract, and for any breaches, defaults, or for any torts in the performance of or in relation to the Contract by IPA, IPSC, or the Operating Agent, or any officers, agents, or employees thereof. Contractor hereby expressly covenants and agrees that no suit shall be brought by Contractor against IPSC, or the Operating Agent, or their, or IPA's officers, agents, or employees, or any of the purchasers of power from IPA, but that all rights or remedies that Contractor may have or that may arise under or in relation to the Contract shall be asserted by Contractor solely against IPA. Without limiting the foregoing provisions of this Article, Contractor shall have no right against any of the foregoing (including IPA) to assert or recover, in contract or in tort, damages or losses in the nature of consequential damages, incidental damages, or punitive or exemplary damages.

14. Independent Contractor: Contractor shall perform all Work as an independent contractor in the pursuit of its independent calling. Contractor is not an employee, agent, joint venturer, partner, or other representative of IPA, IPSC, or the Operating Agent and shall be under the control of IPSC only to provide the Work requested and not as to the means or manner by which the Work is to be accomplished. Contractor has no authority to act for, bind, or legally commit IPA, IPSC, or the Operating Agent in any way.

15. Drug Policy: Contractor shall submit a current copy of its drug policy for review. IPP Facilities are a drug free and zero tolerance workplace. Contractor's employees and its subcontractors' employees, who are to perform Work or otherwise be at the IPP Facilities, shall participate in a drug testing program prior to arrival, and at any additional time(s) during the Contract as IPSC may request.

16. Security and Safety Compliance: Contractor and its employees, agents, representatives, and/or subcontractors, while performing Work on IPP premises, or who are otherwise on IPP premises, shall fully comply with all security, fire prevention, and safety rules and procedures in force at IPP. IPSC has the right (but not duty) to make periodic and random inspections of the persons, and of their respective property, upon entering, at any time while on, and when departing any IPP facility. Such persons subject to inspection include Contractor, any subcontractor, and their respective employees, agents, and representatives. Property subject to inspection includes, but is not limited to, vehicles, clothing, toolboxes, lunch boxes, any other carrying case, tools or equipment, and anything contained therein. If violations are noted, the violations will be reported to Contractor's on-site supervisor and the Contract Administrator for appropriate action.

All Contractor's employees will be given security identification badges by IPSC and those badges shall be displayed each day to allow admittance on IPP premises. Contractor's employees who do not have security identification badges in their possession, will not be allowed on the IPP Job Site unless signed in by the Contract Administrator. All security identification badges shall be returned to the Security Contractor when the employee terminates their work at the IPP Job Site. All Contractor's vehicles will also receive parking stickers from the Security Contractor allowing entrance on IPP Premises. Temporary badges and parking stickers are available for intermittent Contractor employees and vehicles.

Contractor shall have access on IPP premises between the hours of 7:00 am to 7:00 pm Monday through Friday. Access may be allowed on weekends or at other times with the approval of the Contract Administrator.

Contractor will be directed to specified areas for parking vehicles and equipment by the Contract Administrator. Certain areas of IPP premises are restricted to IPSC vehicles only. Exceptions to the parking restriction will be made on an as needed basis through

Contractor's respective Contract Administrator. Contractor shall make its employees, agents, representatives, and/or subcontractors aware of all areas that are subject to restricted parking.

Contractor agrees, warrants, and represents that: (a) It is familiar with the risks of injury associated with the Work and otherwise being on IPP Premises; (b) Has reviewed the Work to be performed; (c) Has inspected the IPP Job Site with an IPSC representative, and (d) has determined that no unusual or peculiar risk of harm exists with regard to the Work to be performed on IPP Premises. Contractor further agrees that it shall, at all times, provide on IPP premises, a competent supervisor(s) familiar with IPSC's and the

industry's safety standards to ensure compliance with all federal, state, and local regulations pertaining to safety (including, but not limited to, Federal and State OSHA, as said regulations relate to the Work to be performed under the Contract). Although IPSC assumes no responsibility to oversee or supervise the Work, IPSC reserves the right to review safety programs and practices and to make recommendations to Contractor. No such review or recommendation by IPSC shall impose any liability or responsibility on IPSC, or relieve Contractor from providing a safe working environment and complying with all legal requirements.

Contractor shall comply with IPSC's safety and equipment requirements prior to starting the Work. Worker protective clothing, which includes, but is not limited to, hardhats, safety glasses, safety shoes, gloves, respirators, earplugs, safety harnesses, and face shields shall be provided by Contractor.

Prior to starting the Work, all of Contractor's personnel shall attend a safety orientation taught by a representative of IPSC. At Contractor's option and subject to IPSC approval, a supervisor of Contractor may attend the orientation taught by IPSC, and then present the orientation to the remainder of Contractor's personnel. In that case, a roll shall be provided to IPSC which lists each person who received the orientation and the date it was received.

17. Nonexclusive: This is a nonexclusive Contract. IPSC reserves the right to obtain services, materials, equipment, or other Work from other vendors or suppliers.

PART E - DIVISION E2

ADDITIONAL GENERAL CONDITIONS

1. Guarantee: Contractor guarantees and warrants for a minimum period of one (1) year after delivery, and for such longer period as may be specified by the applicable statute of limitations, that all materials, services, equipment, and other Work furnished are free from defects and otherwise conform to the terms of the Contract, including, but not limited to, the Article entitled "Materials and Work" in Part E, Division E1, General Conditions.

   Contractor shall repair or replace, as IPSC may direct, all defective materials, services, equipment, or other Work. Such repair or replacement shall be F.O.B. at such destination as IPSC may direct (contract delivery point, point of installation, point of consumption, etc.). IPSC's right to demand repair or replacement is in addition to any other remedies that may be available for breach of the foregoing guarantee and warranty.

   Contractor shall, for the protection and benefit of IPA, IPSC, and LADWP, obtain guarantees conforming to the foregoing two (2) paragraphs from each of its vendors and subcontractors with respect to their materials, services, equipment, or other portion of the Work. Such guarantees from vendors and subcontractors shall be in addition to, and not in lieu of, Contractor's own guarantees.

2. Payment: Payment will be made within thirty (30) calendar days after delivery and receipt of the invoice in the form directed by IPSC.

3. Invoices: Invoices shall be submitted in duplicate to Accounts Payable, Intermountain Power Service Corporation, 850 West Brush Wellman Road, Delta, Utah 84624-9546. All letters pertaining to invoices shall be addressed to the foregoing address.

   All invoices shall show the Contract number, release number, or other identification of each delivery covered by the invoice. In all cases, the amount of the applicable sales tax or use tax shall be separately stated on the invoice.

4. Regulations, Permits, Licenses, and Warrants: Contractor shall comply with all applicable federal, state, and local regulations including, but not limited to, Federal and State OSHA, as said regulations relate to the Contract, Contractor's performance, or Contractor's trade. In addition, Contractor shall ensure that all permits, licenses, and warrants relating to the Contract, Contractor's performance, and Contractor's trade be acquired.

5. Letters to IPSC: All inquiries relating to these Specifications prior to award of Contract shall be addressed to the Buyer.

After award of Contract, all letters pertaining to performance of the Contract (other than invoice) shall be addressed as follows:

Mr. George W. Cross
President and Chief Operations Officer
Intermountain Power Service Corporation
850 West Brush Wellman Road
Delta, UT 84624-9546

Attention: Jon Christensen,
Contract Administrator

Regarding Contract No: **04-45605**

PART F - DIVISION F1

DETAILED SPECIFICATIONS - SPECIAL CONDITIONS

1. General: Under the terms of the Contract, Contractor shall furnish and deliver **up to eight (8) Induced Draft Fan Medium Voltage Variable Frequency Drive Systems** ordered by IPSC during the period of four (4) years beginning with date stated in the first introductory paragraph of the Contract Agreement (hereinafter called the Contractual Period).

2. Quantity: IPSC agrees to purchase **up to eight (8) Induced Draft Fan Medium Voltage Variable Frequency Drive Systems** during the Contractual Period.

   In consideration of the above agreed purchase quantity, IPSC will, during the Contractual Period, have the option (but not duty) to purchase **Induced Draft Fan Medium Voltage Variable Frequency Drive Systems** up to a quantity of eight (8). Said option may be exercised, in whole or in part, by the issuance to Contractor of releases for any portion thereof by the Buyer or the Buyer's duly authorized representative. Nothing contained herein shall require IPSC to order any of its requirements beyond the quantities stated in Division A1 from Contractor as opposed to from other suppliers or contractors.

3. Delivery: Contractor shall make deliveries only upon receipt of releases issued by the Buyer. IPSC reserves the right to specify in said releases the amounts and dates of deliveries at the location described in the Proposal Schedule. IPSC will require ID fans to be delivered as indicated in Division F2, Article 15, Schedule of Activities, in the table titled, Equipment to be Delivered to the Job Site.

   Deliveries shall be made between the hours of 8:00 a.m and 3:00 p.m., except holidays, Monday through Friday, unless other arrangements are made in writing between Contractor and Buyer.

4. Printed Documents: All printed documents, including drawings and instruction books, if applicable, shall be in the English language. All units of measurement shall be in the English foot-pound-second system.

5. Delivery Arrangements: After award of the Contract and prior to delivery or other performance of any Work, Contractor shall become familiar with the unloading facilities at the delivery point(s) set forth in the Proposal Schedule, either by personal inspection or by contacting the Contract Administrator, (435) 864-4414.

6. Indemnity Clause: Contractor undertakes and agrees to indemnify, hold harmless, and at the option of the IPA, defend IPA, IPSC, LADWP, and any and all of their boards, officers, agents, representatives, employees, assigns, and successors in interest from and against any and all suits and causes of action, claims, charges, costs, damages, demands, expenses (including, but not limited to, reasonable attorneys' fees and cost of

litigation), judgments, civil fines and penalties, liabilities or losses of any kind or nature, including, but not limited to, violations of regulatory law, breach of contract, death, bodily injury or personal injury to any person, including Contractor's employees and agents, or damage or destruction to any property of either party hereto, or of third persons, arising in any manner by reason of or incident to the performance of the Contract on the part of Contractor, or Contractor's officers, agents, employees, or subcontractors of any tier, except as may be caused by the sole negligence of IPA, IPSC, LADWP, or their boards, officers, agents, representatives, or employees.

7. Insurance Requirements: Prior to the start of the Work, but not later than thirty (30) calendar days after date of award of Contract, Contractor shall furnish IPSC evidence of coverage from insurers acceptable to IPSC and in a form acceptable to IPSC Insurance Analyst. Such insurance shall be maintained by Contractor and at Contractor's sole cost and expense.

Such insurance shall not limit or qualify the liabilities and obligations of Contractor assumed under the Contract. IPA, IPSC, or LADWP shall not, by reason of any of their inclusion under these policies or otherwise, incur liability to the insurance carrier for payment of the premium for these policies.

Any insurance carried by IPA, IPSC, or LADWP which may be applicable is and shall be deemed excess insurance, and Contractor's insurance is and shall be primary for all purposes despite any provision in Contractor's policies to the contrary.

Should any portion of the required insurance be on a "Claims Made" policy, Contractor shall, prior to the policy expiration date following completion of the Work, provide evidence that the "Claims Made" policy has been renewed or replaced with the same limits and terms and conditions of the expiring policy at least for the Contract under which the Work was performed.

a. Workers' Compensation/Employer's Liability: Workers' Compensation Insurance covering all of Contractor's employees in accordance with the laws of all states in which the Work is to be performed and including Employer's Liability Insurance, and as appropriate, Broad Form All States Endorsement, Voluntary Compensation, Longshoremen's and Harbor Workers' Compensation, Jones Act, and Outer-Continental Shelf coverages. The limit for Employer's Liability coverage shall be not less than $1 million each accident and shall be a separate policy if not included with Workers' Compensation coverage. Evidence of such insurance shall be an endorsement to the policy providing for a thirty (30) calendar days prior written notice of cancellation or nonrenewal of a continuous policy to IPSC, by receipted delivery, and a Waiver of Subrogation in favor of IPA, IPSC, and LADWP, its officers, agents, and employees. Workers' Compensation/Employer's Liability exposure may be self-insured provided that IPSC is furnished with a copy of the certificate issued by the state authorizing

Contractor to self-insure. Contractor shall notify IPSC, by receipted delivery, as soon as possible of the state withdrawing authority to self-insure.

b. Commercial General Liability: Commercial General Liability with Blanket Contractual Liability, Products and Completed Operations, Broad Form Property Damage, Premises and Operations, Independent Contractors, and Personal Injury coverages included. Such insurance shall provide coverage for total limits actually arranged by Contractor, but not less than $2 million Combined Single Limit and be specific for the Contract. Should the policy have an aggregate limit, such aggregate limits should not be less than $4 million. Umbrella or Excess Liability coverages may be used to supplement primary coverages to meet the required limits. Evidence of such coverages shall be on IPSC's Additional Insured Endorsement Form or on an endorsement of the policy acceptable to IPSC and provide for the following:

(1) To include IPA, IPSC, LADWP, and their officers, agents, and employees as additional insured with the Named Insured for the activities and operations under and in connection with the Contract.

(2) That the insurance is primary and not contributing with any other insurance maintained by IPA, IPSC, or LADWP.

(3) A Severability-of-Interest or Cross-Liability Clause such as: "The policy to which this endorsement is attached shall apply separately to each insured against whom a claim is made or suit is brought, except with respect to the limits of the company's liability."

(4) That the policy shall not be subject to cancellation, change in coverage, reduction of limits or nonrenewal of a continuous policy, except after written notice to IPSC, by receipted delivery, no less than thirty (30) calendar days prior to the effective date thereof.

(5) A description of the coverages included under the policy.

c. Commercial Automobile Liability: Commercial Automobile Liability covering the use of owned, nonowned, hired, and leased vehicles for total limits actually arranged by Contractor, but not less than $1 million Combined Single Limit. Such insurance shall include Contractual Liability coverage. The method of providing evidence of insurance and requirements for additional insureds, primary insurance, notice of cancellation, and Severability-of-Interest shall be the same as required in the Commercial General Liability Division of terms and conditions.

d. Professional Liability: Contractor shall provide Professional Liability Insurance with Contractual Liability coverage included, covering Contractor's liability arising from errors and omissions made directly or indirectly during the execution and performance of the Contract and shall provide coverage of $5 million Combined Single Limit. Evidence of such insurance shall be in the form of a special endorsement of insurance and shall include a Waiver of Subrogation against IPA, IPSC, and LADWP, their officers, agents, and employees.

The policy shall not be subject to cancellation, change in coverage, reduction of limits, or nonrenewal of a continuous policy, except after written notice to IPSC, by receipted delivery, not less than thirty (30) calendar days prior to the effective date thereof.

e. Other Conditions:

(1) Failure to maintain and provide acceptable evidence of any of the required insurance for the required period of coverage shall constitute a major breach of Contract, upon which IPSC may immediately terminate or suspend the Contract. In addition or in the alternative, IPSC has the right (but not duty), to procure such insurance and: (a) To deduct the cost thereof from any monies due Contractor under the Contract or otherwise; and/or (b) To charge and collect the cost thereof from Contractor, payable upon demand. Such claim, deduction, or charge shall include an administrative fee of two (2) percent of the cost of procuring said insurance. Said insurance may be procured and maintained in the name of Contractor, IPA, IPSC, LADWP, and/or any combination thereof, as primary and/or secondary insured, all as IPSC may from time to time elect.

(2) Contractor shall be responsible for all subcontractors' compliance with these insurance requirements. The foregoing remedies in subsection (1) shall be available to IPSC against Contractor for any failure by any subcontractor to maintain and provide the required insurance.

8. Transportation: All shipments of hazardous materials under the Contract or in connection herewith shall be handled in accordance with current U.S. Department of Transportation regulations and all other applicable federal, state, and local laws and regulations.

9. Material Safety Data Sheets: Contractor shall furnish IPSC with a Material Safety Data Sheet (MSDS) for all hazardous materials furnished under the Contract, used, stored, or transported on or near IPP premises in connection with the Contract. The MSDS shall be furnished to IPSC on, or prior to, the date of the first delivery, use, storage, or

transportation of the materials or equipment. If these Specifications require that Contractor furnish instruction books, the MSDS shall also be included in such books.

10. Contract Termination:

a. For Convenience or Security: IPSC reserves the right, by giving twenty (20) calendar days prior written notice (or such longer notice as IPSC may select) to Contractor, to terminate the whole or any part of the Contract at IPSC's convenience, whether or not Contractor is in default. IPSC also reserves the right to terminate the Contract, effective immediately upon notice, for purposes of security or safety of IPP Facilities, persons who work at IPP Facilities, or the public. In the event of termination for convenience, security, or safety, IPA will pay Contractor reasonable and proper direct costs of termination (if, however, Contractor's Proposal includes cancellation charges, payment for termination costs shall not exceed the cancellation charges set forth therein). Contractor shall, after consultation with IPSC, take all reasonable steps to minimize the costs related to termination. Contractor shall provide IPSC with an accounting of costs claimed, including adequate supporting information and documentation and IPSC may, at its expense, audit the claimed costs and supporting information and documentation.

b. For Breach: IPSC may terminate the whole or any part of the Contract effective immediately upon notice, in the event Contractor is in material default, and without right on the part of Contractor to claim any termination costs. This right to terminate is in addition to, and not in lieu of, any other remedy provided in the Contract or otherwise provided by law or equity.

c. Limitation of Liability: In no event shall termination of this Contract, or any portion thereof, whether for convenience, security, safety, breach, or otherwise, constitute the basis for or result in any claim by Contractor for consequential or incidental damages (including loss of anticipated profits or other economic damages) or punitive damages, and Contractor hereby releases IPA, IPSC, and LADWP, and their officers, directors, employees, agents, and representatives, from any and all such claims or liability.

11. Suspension of Work: IPSC reserves the right to suspend and reinstate execution of the whole or any part of the Contract and the Work without invalidating the provisions of the Contract. In the event the Work is suspended, Contractor will be reimbursed for actual direct unavoidable costs that it reasonably incurs as a result of the suspension. Claims for such cost reimbursement shall be submitted by invoice. Contractor shall use all reasonable means to minimize such costs, and shall allow IPSC to audit costs claimed. Contractor shall, upon request by IPSC, provide a projection of costs it anticipates to incur during any suspension, or continuation of suspension, contemplated by IPSC. In no event shall suspension constitute the basis for, or result in, any claim for

consequential or incidental damages (including loss of anticipated profits or other economic damages) or punitive damages, and Contractor hereby releases IPA, IPSC, and LADWP, and their officers, directors, employees, agents, and representatives, from any and all such claims or liability.

12. No Waiver: No breach, noncompliance, or other failure to perform (collectively "breach") by Contractor, or any subcontractor, or of any Work shall be deemed waived unless expressly waived in writing by the President and Chief Operations Officer. No waiver by IPSC of any one breach shall be deemed to waive any other prior, concurrent, or subsequent breach. No exercise, or failure to exercise, or delay in exercising any particular remedy by IPSC shall be deemed a waiver or preclude IPSC from subsequently invoking that remedy for that breach or any other breach. All remedies granted to IPSC in the Contract, or by law or equity, are cumulative and may be exercised in any combination or order.

THIS CONTRACT AGREEMENT, entered into this _____ day of _____ 20___, between the **INTERMOUNTAIN POWER SERVICE CORPORATION** (IPSC), a nonprofit organization under contract to the Intermountain Power Agency (IPA), a political subdivision of the state of Utah, organized and existing under the laws of the State of Utah, pursuant to the Chapter 13, Utah Code Annotated 1953, as amended, and _____, a _____, with its principal office in _____, hereinafter called the Contractor,

WHEREAS, IPSC has prepared specifications and other Contract Documents for **up to eight (8) Induced Draft (ID) Fan Medium Voltage Variable Frequency Drive Systems** as detailed in the Contract Documents (the Work), and has requested proposals from bidders to perform the Work;

WHEREAS, Contractor has submitted to IPSC a Proposal in accordance with the terms of this Contract Agreement; and

WHEREAS, IPSC has determined and declared Contractor to be the lowest and best, regular responsible bidder for the said Work, subject to execution of this Contract Agreement;

AGREEMENTS

In consideration of the compensation to be paid to Contractor, and of the mutual terms and conditions contained herein, IPSC for itself and its successors, and Contractor for itself and its permitted successors and assigns, hereby agree as follows:

ARTICLE I. Contractor shall perform in accordance with the provisions of this Contract Agreement, including the Contract Documents identified in Article III hereof.

ARTICLE II. Contractor will be paid for its performance under this Contract Agreement in accordance with the provisions of the Contract Documents, including those provisions in the Article entitled "Limitation of Liability, Responsible Party" in Part E, Division E1, General Conditions.

ARTICLE III. The term "Contract Documents" means and includes all of the following:

PART F, DIVISION F2

GENERAL DESCRIPTION AND SCOPE OF WORK

The Intermountain Generating Station (IGS) consists of two (2) coal fired generating units with each having a maximum gross capacity of 950 Megawatts. IGS is located in Central Utah.

This Division covers the general description, scope of work and supplementary requirements for equipment, materials, and services included under these Specifications.

The equipment and materials covered by these Specifications will be incorporated in the Intermountain Power Project (IPP) ID Fan VFD System replacement project.

The IPP Plant Site is located at 850 West Brush Wellman Road, Delta, Utah.

It is desirable to provide the best suited and largest standard drive suitable for possible use at a later date due to unforeseen changes that may be required in the future.

Reuse of the existing fan and motor is desirable. If the motor is reused, Contractor shall verify and warrant that the existing motor is acceptable for use with the new system.

The existing output contactors and all power and control electronics shall be replaced.

Contractor shall replace or relocate any and all other items as deemed appropriate; however, Contractor shall include in its Proposal a complete description of the proposed system and what is being replaced and what is being reused.

Contractor shall include in its Proposal a drawing showing the proposed arrangement and dimensions, including clearances between existing items and all new items. This drawing shall also indicate the approximate weight of all components.

2. Existing System Description: Each generating unit has four (4) ID fan rated 7,415 HP at 954 RPM existing maximum speed limit. The motors are 6-phase synchronous, 8-pole, 3,876 volt machines. Each motor has two (2) 3-phase windings. Winding 1 is phase shifted thirty (30) electrical degrees from Winding 2. The motor windings are not re-connectable to change the motor voltage. Each motor is controlled by a pair of current source, load commutated inverter (LCI) variable frequency drives. Each drive has an input transformer to connect the 3,876 volt drive to the 6,900 volt circuit breaker. The transformer pairs are connected delta-delta and delta-wye such that the 6,900 volt bus sees harmonics associated with 12-pulse rectification at full load of the drives. The motors and drives are about twenty (20) years old and were manufactured by Westinghouse. The drive controls are a combination of analog and digital technologies.

3. New System Requirements: The replacement equipment must include features that will fulfill the following requirements:

Harmonic content on the 6,900 volt bus must meet IEEE 519.
Power factor at the 6,900 volt feed to each ID fan shall be 0.95 or better at full load. *Contractor shall include in its Proposal the power factor at 25, 50, 75, 85,* and 100 percent loads.
Existing fan capacities shall not be decreased.
External controls and interlocks of the new equipment shall coordinate with the existing plant control system.
New components proposed must not degrade rating or service life of existing components that are being reused.
Contractor shall include in its Proposal the guaranteed reliability and maintainability of ID fan system. New equipment must fit in existing space.
It is desirable to have the new equipment use the existing conduits that are encased in concrete to minimize the installation costs. If necessary, others will do core drilling of the concrete; however, Contractor shall list all core drilling necessary in its Proposal.
Equipment for VFDs shall be replaced and checked out during a scheduled twenty-four (24) calendar day outage. Contractor shall include in its Proposal a description of the ***work*** required for complete replacement.

4. Long Range Goals: The replacement equipment shall have features that will provide or make provision for the following goals:

Increased fan capacity to allow a 950 MW generating capacity with three (3) fans operating with additional pollution control equipment added.
Provide for future ID fan increases using Contractor's standard equipment.
Replace existing transformers.

5. Work Included Under These Specifications: The Work under these Specifications shall include furnishing F.O.B. at the IPP Plant Site, the medium voltage VFDs, miscellaneous materials, and services complete as specified herein and in accordance with the Contract Agreement.

All equipment and materials required for complete medium voltage VFD systems shall be furnished, except as specified otherwise in these Specifications. The equipment, materials, and services to be furnished shall include, but not necessarily be limited to, the following major items:

a. The furnishing of integrated medium voltage VFD systems, to operate the ID fans. Each set shall be an engineered system composed of the existing input switchgear, a VFD, self-contained closed cycle cooling system, and output contactor with connections to an existing or replacement ID fan motor. Drive equipment shall be housed in the existing control building. Equipment and software furnished shall be suitable for powering IPSC's ID fan motors or new motors provided by Contractor. Contractor shall identify any modifications required to IPSC's ID fan system, composed of ID fan motor, fan, connecting shaft, bearings, and cable connecting the ID fan motor to the VFD system to allow this equipment to operate with the VFD and still maintain a normal lifetime of the ID fan system. Contractor shall also provide services to coordinate the proper selection of IPSC's ID fan system and programming of the VFD software. This includes, but is not limited to, coordination of information transfer associated with IPSC's ID fan system, such as WK^2 of the fan, critical speeds, starting/running torque, and meetings with the new or existing fan motor supplier.

b. Each VFD system shall consist of all system components required to meet the performance, protection, safety, testing, and certification criteria of these Specifications. These components may include incoming harmonic filter/power factor correction unit, input isolation transformer, VFD converter/DC-link/inverter, and output filter. The VFD system shall represent a fully integrated package. All material and labor necessary to interconnect any VFD system elements shall be included, even if shipped separately, except as specified otherwise herein. The minimum VFD size shall be such that the motor will operate continuously at the horsepower rating multiplied by the motor service factor.

c. It is intended that Contractor's standard product, with available options, be provided under these Specifications. Any modifications to a standard product provided to meet these Specifications shall be performed by Contractor only. Contractor shall explicitly indicate all exceptions or deviations to these Specifications in its Proposal, per Division B1, Article 4, Instructions to Bidders. Only exceptions or deviations identified in the Proposal Section will be considered for negotiation and possible inclusion in the executed Contract.

d. The main VFD system components shall be completely factory prewired, assembled, and then tested as a complete package by Contractor, to assure a properly coordinated, fully integrated drive system. It is desirable that the factory acceptance tests include all components being furnished, including the transformer.

e. Contractor shall conduct a certified startup of all Contractor-furnished equipment to confirm conformance to these Specifications.

f. Any third party certification, safety, or protection requirements shall be applied to the VFD system as a whole. Certification or protection of system elements or individual components by themselves is not acceptable.

g. IPSC will test the equipment after erection to demonstrate its ability to operate under the specified conditions and fulfill the guarantees as set forth herein. If the tests indicate that the equipment fails to meet guaranteed performance, Contractor shall make additional tests and modifications until the equipment performs as specified.

h. Contractor shall provide drawings and other engineering data, manufacturer's field services, tools, instruction manuals, recommended spare parts list, and miscellaneous materials and services, and shall participate in design conferences, all as specified herein.

i. Equipment, materials, and accessories furnished shall be delivered to the IPP Job Site where items will be unloaded, received, stored, and erected under separate purchase orders. Deficiencies shall be sufficient cause to reject equipment. Unloading from carrier and storing will not constitute acceptance.

6. Miscellaneous Materials and Services: Miscellaneous materials and services not otherwise specifically called for shall be furnished by Contractor in accordance with the following:

a. All piping integral to or between any equipment furnished under these Specifications, except as otherwise specified.

b. All necessary instrument, power and control wiring, and raceways integral to any equipment furnished under these Specifications. This shall include terminal blocks and internal wiring to these terminal blocks for equipment requiring external connection.

c. Coupling guards for all exposed shafts and couplings.

d. Leveling blocks, soleplates, thrust blocks, and matching blocks.

e. Erection drawings, prints, information, instructions, and other data for use by IPSC's erection subcontractor.

f. Detailed storage and lubrication requirements (including frequencies) for use by IPSC's erection subcontractor.

g. The use of all special tools required for erection of the equipment, exclusive of the maintenance tools specified to be furnished under Division F3, Article 15, General Equipment Specifications. Erection tools shall remain the property of

Contractor and all shipping costs to and from the IPP Job Site shall be at Contractor's expense.

7. Work or Materials Furnished by Others: IPSC will furnish the following items:

   a. ID fan system, composed of ID fan motor (if existing motor is used), ID fan, connecting shaft, bearings, and cable connecting the ID fan motor for each ID fan (if Contractor verifies existing cabling is acceptable). The connecting cable will be shielded 8 kV Type MV-90 single conductor medium voltage power cable. The WK^2 of the fan is 347,700 lb-ft^2. The fan will be a variable torque load and high breakdown/starting torque will be required.

   b. One (1) or two (2) 6.9 kV incoming power feeds to each Contractor-furnished VFD system.

   c. One (1) 125 volt DC power feed to each Contractor-furnished VFD.

   d. Control wiring from IPSC's plant control system to the VFD control system.

   e. Supply and install power cables as required to interconnect the VFDs, isolation transformers, input circuit breakers, and ID fan motors.

   f. Receiving, unloading, storing, and field erection of all equipment.

   g. Foundations, foundation bolts, bolt sleeves, and equipment bases.

   h. Grouting materials and the placing thereof.

   i. Permanent electric wiring to connect equipment terminal boxes to IPP's electrical system.

   j. Lubricants and fuels for operation.

   k. Solvents and cleaning materials.

   l. Finish painting of all equipment except as specified herein.

   m. Operating personnel for startup and tests.

8. Contractor's Services: Contractor's services as stated in Division F2, Article 5, Work Included Under These Specifications, shall be in accordance with the following:

   a. Submittal of Engineering Data: Drawings and other engineering data for the specified equipment and materials are vital to the design and subsequent construction of the entire project.

Contractor will be required to submit drawings and engineering data in accordance with the schedule and requirements specified herein to assure compliance with the overall construction and operating schedule. Contractor shall allow a reasonable amount of time for mailing, processing, and IPSC Contract Administrator's review of drawings and data in Contractor's schedule and procurement/production/shipping schedule.

b. Manufacturer's Technical Services: Contractor shall furnish the service of one (1) or more manufacturer's technical service representatives. The service representatives shall be technically competent, factory trained, experienced in the installation and operation of the equipment, and authorized by the manufacturer to perform the Work stipulated.

The Manufacturer's technical service representatives shall furnish written certification to IPSC that, the equipment has been inspected and adjusted by or under representatives direction and that the equipment is ready for service, all of which shall be done before initial operation of the equipment.

The duties of manufacturer's technical services representatives may include, but may not be limited to, the following:

(1) Provide technical advice to assist the erection subcontractor in installing the equipment.

(2) Inspect and test the equipment after installation and direct any change or adjustments required to assure proper operation.

(3) Provide technical direction during startup and initial operation of the equipment.

(4) Direct the correction of any design or manufacturing errors.

(5) Instruct IPSC's personnel in the operation and maintenance of the equipment.

(6) Provide services required as a condition to providing the warranties and guarantees specified.

For each VFD system, the lump sum prices stated in the Proposal, shall include the recommended number of days of service and round trips to the IPP Job Site for field service. Contractor shall include as a minimum fifteen (15) days per drive. The manufacturer's technical representatives, shall provide the services specified under items (1), (2), (3), and (6) above. When, in the judgment of the Contract Administrator, field service representative's time is required under item (4) above solely and expressly, for the purpose of correcting design or manufacturing errors, no payment will be made,

nor will the time spent at the IPP Job Site while correcting such errors apply toward the days of service or round trips specified in items (1), (2), (3), and (6) above.

When additional field service representatives time is required by IPSC under item (5) above, the per diem rates for service time, plus the rate for each round trip, will be paid in accordance with applicable adjustment prices for manufacturer's technical services as stated in the Proposal.

The per diem rates shall include all costs associated with the field service representative's Work at the IPP Job Site, including local travel, local travel time wages, and living expenses. The round trip rate shall include all expenses for travel to and from the manufacturer's facilities and the IPP Job Site, including any salary costs for travel time. IPSC will not reimburse Contractor for air fare costs exceeding tourist class air fare unless unusual circumstances exist. Contractor shall notify IPSC of such circumstances.

A day of service (per diem) is defined as eight (8) man-hours at the IPP Job Site. The total number of days of service shall be defined as the total regular time man-hours at the IPP Job Site divided by eight (8).

9. Instruction Manuals: Instruction manuals shall be furnished in accordance with the requirements stated in Division F4, Article 9, Engineering Data, of these Specifications and as scheduled herein.

10. Recommended Spare Parts: Contractor shall provide a complete listing of recommended spare parts with unit prices F.O.B., IPP Plant Site, not later than the date listed in Division F2, Article 15, Schedule of Activities. The listing shall include the manufacturer of each part, a description of each part (including industry standard part number if available), the assembly or equipment in which each part will be used, and recommended quantities to be stocked; shall classify the relative criticality of parts based on the manufacturer's experience; and shall list the lead time required for manufacturer and delivery of each part.

IPSC will retain the option of purchasing any one or any combination of spare parts listed at the prices quoted until six (6) months after final startup testing and acceptance.

11. Factory Witness Tests: Supplementing the provisions of Division F7, Division F8, and Division F9 concerning factory witness tests, Contractor shall notify IPSC's Contract Administrator not less than ten (10) working days prior to the date of each factory witness test. IPSC's Contract Administrator will have the right to witness the factory acceptance test and be present for all other tests conducted.

12. Schedule: Contractor shall complete the specified activities in accordance with the milestone time periods and dates listed in addition to the timely delivery of the equipment and materials.

The Schedule of Activities stipulates the milestone dates and time periods for the Work included in the Contract. It is necessary that Contractor perform the activities shown on or before the dates indicated to avoid delay of the entire project.

a. Activity Periods and Dates: The time periods and dates listed in the Schedule of Activities indicate the latest dates by which the listed activities shall be completed. Data, drawings, and lists for planning, engineering, and documentation may be submitted earlier than the indicated dates at Contractor's option.

   Equipment and materials shall be delivered within the time frame specified. IPSC will not be obligated to accept delivery or make payment for equipment delivered prior to the earliest acceptable delivery date.

b. Engineering Schedule: Contractor shall submit a schedule for engineering associated with the equipment being provided. Such schedules shall be updated and submitted by the first of each month until completion of the engineering effort.

c. Procurement/Production/Shipping Schedule: Contractor shall submit a detailed procurement/production/shipping schedule for the equipment and materials not later than the date indicated; thereafter, the schedule shall be updated as directed by IPSC's Contract Administrator; however, at least every thirty (30) days.

13. Reference Drawings: Contractor shall field verify the information shown on the referenced drawings for any information that is used in the design and fabrication of the variable frequency ID fan drive equipment. All travel and living expenses expended by Contractor for field verification of Reference Drawings, shall be included in the lump sum Contract Price. Refer to Division F2, Drawing List, for drawings included with these Specifications.

14. Right to Operate Unsatisfactory Equipment: If the operation of the equipment after installation proves to be unsatisfactory to the Contract Administrator, IPSC shall have the right, but no duty, to operate such equipment until it can be taken out of service without injury to IPSC for the correction of defects, errors, or omissions.

15. Schedule of Activities: Contractor shall be required to complete the following:

Activity	Days After Award of Contract
Planning, Engineering, and Documentation	
Participate in Design Conference at the IPP Job Site	Fifteen (15) Days
Supply Schedule of Engineering	Fifteen (15) Days
Supply Quality System Manual as Specified in Division F3	Twenty (20) Days
Supply Inspection and Test Plan as Specified in Division F3	Thirty (30) Days Prior to First Fabrication
Supply Notification of Tests/Test/ Inspections as Specified in Division F3	Ten (10) Days Prior to Inspection
Supply Hazardous Materials Documentation	Thirty (30) Days After Award of Contract and With Material Lists
Supply Outline Drawings	Fifteen (15) Days
Supply Schematic and Wiring Diagrams	Twenty (20) Days
Supply Input/Output List to Plant Control System	Fifteen (15) Days
Supply Block Diagram Showing Basic Control and Protection Systems Specifying the Protection, Control, Trip, and Alarm Functions at Different Locations; and Reference Signals, Commands, and Auxiliary Supplies (i.e., Air, Oil, and Cooling Water)	Fifteen (15) Days
Supply Single-Line Diagram Showing Main and Auxiliary Circuitry, Including Main Power Input, Switchgear, Transformer, VFD, System Earthing and Auxiliary Supplies, Showing All CTs, PTs, Relays, Meters, etc., for the Control, Protection, and Operation of Drive System with Electrical Data (i.e., Voltage, Current, Time Ratings, Impedances, and Tolerances)	Twenty (20) Days

Activity	Days After Award of Contract
Planning, Engineering, and Documentation	
Supply Nameplate Drawings	Fifteen (15) Days
Supply Torsional Analysis	Twenty (20) Days
Supply Efficiency and Power Factor Values	Fifteen (15) Days
Supply Startup and Commissioning Instructions and Data	Six (6) Weeks Prior to Shipment
Supply VFD Equipment Interface Information, Including Dead and Seismic Loads	Twenty (20) Days
Supply Anchor Bolt Information, Including Material, Size, and Projection	Twenty (20) Days
Supply Certified Report, Including Test Data for all System Level Tests	Fifteen (15) Days After Completion of System Level Tests
Supply Schedule of System Level Tests, Including Proposed Test Procedures	Thirty (30) Days Prior to Tests
Supply Schedule of Certified Field Startup and Acceptance Tests	Thirty (30) Days Before Shipment
Supply Completed Motor Information Sheets to IPSC's Contract Administrator	Fifteen (15) Days
Supply Cash Flow Projection	Fifteen (15) Days
Supply Initial Detailed Procurement, Production, Shipping Schedule	Fifteen (15) Days
Supply Recommended Detailed Erection Sequence and Procedure	Twenty (20) Days
Submit "Proof Copy" of Instruction Manual(s) to IPSC's Contract Administrator	Thirty (30) Days Prior to Shipment
Distribute Twelve (12) Copies Each for Unit 1 and 2 of Accepted Instruction Manuals as Designated by IPSC's Contract Administrator	Thirty (30) Days Prior to Shipment
Supply Recommended Spare Parts List to IPSC's Contract Administrator	Thirty (30) Days Prior to Shipment

Activity	Days After Award of Contract
Planning, Engineering, and Documentation	
Notify IPSC's Contract Administrator for Pre-Shipment Inspection	Thirty (30) Days Prior to Shipment
Notify IPSC's Contract Administrator of Factory Witness Test(s)	Ten (10) Days Prior to Date of Test(s)

Equipment to be Delivered to IPP Job Site		
Equipment	**Earliest Acceptable Delivery Date**	**Latest Acceptable Delivery Date**
Unit 2 - One (1) Fan	January 02, 2004	February 20, 2004
Unit 1 - Two (2) Fans	January 02, 2005	January 31, 2005
Unit 2 - Three (3) Fans	January 02, 2006	January 31, 2006
Unit 1 - Two (2) Fans	January 02, 2007	January 31, 2007

Twenty-Four (24) Day Plant Outages (For Installation of Equipment, Final Startup Testing, and Acceptance)	
Unit	**Date**
Unit 2 - One (1) Fan	March 2004
Unit 1 - Two (2) Fans	March 2005
Unit 2 - Three (3) Fans	March 2006
Unit 1 - Two (2) Fans	March 2007

Note: Exact Dates to be Determined After Award of Contract

DRAWING LIST

The following reference drawings and pictures are included on the CD that is included with these Specifications:

Existing Design Drawings		
Drawing Number	**Rev**	**Title**
9255-1APE-E1002	9	One-Line Diagrams Overall Functional Relaying
9255-1APE-E1006	8	One-Line Diagrams 6900V Unit Switchgear 1A2
9255-1APE-E1008	9	One-Line Diagrams 6900V Unit Substation 1B2
9255-1BSB-M1040	13	Plant Arrangement - AQCS Control Bldg and ID Fan Area Ground Floor - El 4676'0"
9255-1BSB-M1041	9	Plant Arrangement - AQCS Control Bldg and ID Fan Area Mezzanine Floor - El 4692'0"
9255-2APE-E1002	4	One-Line Diagrams Overall Functional Relaying
9255-2APE-E1006	5	One-Line Diagrams 6900V Unit Switchgear 2A2
9255-2APE-E1008	5	One-Line Diagrams 6900V Unit Substation 2B2
9255-2BSB-M1040	8	Plant Arrangement - AQCS Control Bldg and ID Fan Area Ground Floor - El 4676'0"
9255-2BSB-M1041	6	Plant Arrangement - AQCS Control Bldg and ID Fan Area Mezzanine Floor - El 4692'0"
Existing ID Fan Drawings		
Drawing Number	**Rev**	**Title**
2090F87	7	Contract Drawing 4132 Special ID Fan CL. 954 ARR. 3 DW W/324" Boxes 60" Tau Disch. CW & CCW Rota
2429D95	2	Fan Foundation System Design Criteria Category IV for Adjustable Speed Drive Systems

Existing Drive and Motor Drawings Pictures	
File Name	**Description**
Pb130002.jpg	Looking West at Unit 2 Wall of AQCS Control Building
Pb130003.jpg	Looking West at Unit 2 Wall of AQCS Control Building and ID Fan 1A
Pb130010.jpg	Looking West at Unit 1 Wall of AQCS Control Building
Pb130012.jpg	Looking West at Uni1 Wall of AQCS Control Building and ID Fan IA

Note: The existing drive and motor drawings are included as files 00250001.tif through 00250156.tif.

PART F - DIVISION F3

GENERAL EQUIPMENT SPECIFICATIONS

1. General: These General Equipment Specifications apply in general to all equipment and materials and are supplementary to the Detailed Specifications. If requirements specified herein are in conflict with requirements specified in the Detailed Specifications, the Detailed Specifications shall govern to the extent of such conflict.

   The Proposal shall be based upon the use of equipment and materials complying fully with the requirements specified in the Contract Documents. It is recognized that Contractor may have standardized on the use of certain components, materials, processes, or procedures different than those specified herein. Alternates in addition to the base Proposal on the basis of supplying Contractor's standard components, materials, processes, or procedures will be considered. The alternate Proposal shall clearly stipulate the alternate proposed, the specific exceptions to the specifications, and the price change applicable for suppling such alternate.

2. Referenced Standards: Reference to the standards of any technical society, organization, or association, or to the laws, ordinances, or codes of governmental authorities shall mean the latest standard, code, or specification adopted, published, and effective at the date of taking bids unless specifically stated otherwise in these Specifications.

   The specifications, codes, and standards referenced in these Specifications (including addenda, amendments, and errata) shall govern in all cases where references thereto are made except where they conflict with these Specifications. In case of conflict between the referenced specifications, codes, or standards and these Specifications, the latter shall govern to the extent of such difference.

3. Materials and Equipment: Unless specifically provided otherwise in each case, all materials and equipment furnished for permanent installation in the Work shall conform to applicable standard specifications and shall be new, unused, and undamaged.

4. Identification: All correspondence, shipping notices, specifications, engineering data, and other documents pertaining to the equipment and materials furnished under these Specifications shall be identified by IPSC's name, the project name and number, the unit number, and the Specifications number.

5. Pre-Shipment Inspection: IPSC Contract Administrator reserves the right to inspect the equipment prior to shipment. Contractor shall notify IPSC's Contract Administrator of all shipments not less than ten (10) working days prior to the date of shipment to allow IPSC's Contract Administrator to inspect the equipment if so desired.

6. Material List: Contractor shall prepare and submit with the first shipping notice two (2) copies of an itemized material list covering all material and equipment furnished under

these Specifications. The material list shall be in sufficient detail to permit an accurate determination of the completion of shipment.

7. Hazardous Materials: All shipments of hazardous materials shall be identified on the material list. A copy of the hazardous materials documentation required per Division F1, Detailed Specifications - Special Conditions, Article 9, Material Safety Data Sheets, shall be included with the material list and shall also be included with the shipping papers attached to the shipment.

8. Correction of Errors: Equipment and materials shall be complete in all respects within the limits herein outlined. All errors or omissions required to be corrected in the field shall be done by the manufacturer or his duly authorized representative at Contractor's expense.

9. Numbering System: IPSC has established an identification numbering system to provide consistent numbering of all plant equipment. All electrical devices, control and instrumentation equipment, valves, and other items of similar nature shall be permanently identified with the identification number supplied by IPSC. Except as specified otherwise in these Specifications, the identification shall be engraved on stainless steel tags, laminated phenolic tags, nameplates, or an equally permanent method at the option of, and as acceptable to, IPSC and shall be permanently affixed to the device. IPSC's identification numbers shall also be included on the manufacturer's drawings.

10. Nameplates: Nameplates shall be furnished for all equipment when specified in the Detailed Specifications.

    Nameplates shall be laminated white phenolic engraving stock with black core, or 2-ply vinyl white with reverse engraved black fill as manufactured by B.F. Plastics of Lawrence, Ohio, or acceptable equal. The lettering shall not be less than 3/16 inch high. As space permits, nameplates shall have an overall minimum size of 3/4 inch by 3 inches for small equipment nameplates, and 2 inches by 8 inches minimum for major equipment nameplates. The nameplate size shall be subject to acceptance by IPSC during drawing review. Nameplates shall be attached with stainless steel screws.

11. Factory Assembly: Equipment shall be shipped completely factory assembled, except when the physical size, arrangement or configuration of the equipment, or shipping and handling limitations make the shipment of completely assembled equipment impracticable, in which case the equipment shall be assembled and shipped as stated in Contractor's Proposal.

    All separately packaged accessory items and parts shall be shipped with the equipment. Containers for separately packaged items shall be marked so the containers are

identified with the main equipment. An itemized packing slip, indicating what is in that container only, shall be attached to the outside of each container used for packaging. A similar list shall be inside of each container. A master packing slip, covering all accessory items for a given piece of equipment which are shipped in separate containers, shall be attached to one (1) container.

12. Service Conditions: Unless specified otherwise, equipment and material furnished under these Specifications shall be suitable for service at an altitude of 4,700 feet above sea level, temperatures between -35°C and 50°C.

    Equipment located outdoors shall also be suitable for exposure to solar radiation, fog, rain, snow, ice, coal dust, fly ash, wind, and windblown dust and sand.

13. Control and Electrical Equipment: Control and electrical equipment, including panels, cabinets, switchgear, transformers, and motors, shall be finish painted. Exterior surfaces shall be the manufacturer's standard color. The interior portions of cabinets shall be gloss white. Touch-up paint shall be provided for repair painting.

14. Protection: All equipment shall be boxed, crated, or otherwise suitably protected during shipment, handling, and storage.

    Electrical equipment, controls, and insulations shall be protected against moisture and water damage.

15. Tools: Contractor shall furnish and ship with each piece of equipment one (1) set of all special tools required for installation and maintenance of the equipment. Maintenance tools for each piece of equipment shall be boxed separately and the boxes shall be marked with the large painted legend as follows:

    INTERMOUNTAIN POWER SERVICE CORPORATION
    INTERMOUNTAIN POWER PROJECT
    MAINTENANCE TOOLS FOR: _____
    (Name of Equipment)

    ERECTION SUPPLIER DO NOT OPEN EXCEPT WITH IPSC'S PERMISSION

    A weatherproofed itemized list of the contents shall also be attached to the outside of each box.

    The maintenance tools shall include all special handling rigs, bars, slings, and cable. All maintenance tools shall be in new and unused condition and shall become the property of IPSC. The bidder's Proposal shall include the list of maintenance tools which shall be furnished with the equipment.

In addition to the tools for maintenance and dismantling, Contractor shall furnish the use of all special tools required for erection of the equipment. Erection tools shall remain the property of Contractor and all shipping costs to and from the IPP Job Site shall be at Contractor's expense. Erection tools for each piece of equipment shall be boxed separately. Erection tools shall not be boxed with maintenance tools.

16. Alignment and Balance: All rotating parts shall be true and dynamically balanced. Excessive noise or vibration, in the opinion of IPSC's Contract Administrator, will be sufficient cause for rejection of the equipment. All rotating equipment shall be balanced at the factory.

17. Noise Level: The equivalent "A" weighted sound pressure level for equipment furnished under these Specifications (excluding drive motors) shall not exceed 85 dBA free field measured 3 feet horizontally from the base of the equipment and 5 feet about floor level. If the drive motors for the equipment are also furnished under these Specifications, the combined sound pressure level of the motor and driven equipment shall not exceed 90 dBA free field. The sound pressure levels stated are decibels to a reference of 20 micropascals.

18. Design Coordination: Contractor shall be responsible for the selection and design of all equipment and materials which will provide the best coordinated performance of the entire system. Components of rotating equipment shall be selected so that the natural frequency of the complete unit is not at or critically near the operating range of the unit.

19. Control Power: Electrical power for control and instrumentation will be a nominal 120 volt, single-phase, 60 hertz, alternating current, or a nominal 125 volt direct current. Contractor shall provide any devices required for proper operation and protection of the equipment during electrical power supply and ambient temperature fluctuations described in the following paragraphs.

All dc electrical control devices shall be designed for continuous operation on an ungrounded station battery at any voltage from 100 to 140 volts dc. Electrical devices served from this supply shall not impose any ground connections on it. All ac electrical control devices shall, unless other specified, be designed for continuous operation at any voltage from 102 to 132 volts alternating current. The dropout voltage shall be less than 75 volts for relays and 90 volts for contactors and starters. Alternating current electrical control devices operating at nominal voltages other 120 volts shall be designed for continuous operation over proportional voltage variations.

All devices shall be guaranteed to operate satisfactorily under voltage conditions specified in the above paragraphs and at a range of ambient temperatures from 50°C to -35°C outdoors and from 50°C to10°C indoors.

20. Auxiliary Power: Auxiliary equipment, such as motors, transformers, and rectifiers, requiring electrical power shall be designed to operate from one of the nominal electrical power sources as follows:

Auxiliary Power		
Volt	**Phase**	**Hertz**
6,900	3	60
480	3	60
208	3	60
120	1	60
125	dc	– (Emergency)

Alternating current motor voltage ratings with relation to horsepower shall be in accordance with the following:

Alternating Current Motor Voltage Rating		
Horsepower	**Volt**	**Phase**
Below ½	115	1
½ through 249	460	3

21. Electrical Enclosure Heating: Where electrical enclosure heating is specified, at least two (2) space heaters, one (1) adjustable thermostat, and one (1) fuse and fuse block shall be provided completely wired in the enclosure. The space heaters, thermostat, and fuse block shall not interfere with normal cable entrance into the enclosure or with maintenance or replacement of devices within the enclosure. Normal use of space heaters shall not change or discolor any painted surface.

Space heater capacity shall be as required to maintain the enclosure internal temperature above the dew point under the specified service conditions. Space heater voltage, for circuits greater than 1,000 watts rating shall be 208 volts. Voltage applied to space heaters, less than 1,000 watts shall be 120 volts. Space heaters shall be controlled by an adjustable thermostat, factory set to close on falling temperature at 80°F (on) and open on rising temperature at 95°F (off). The thermostat shall incorporate an indicating thermometer and set point temperature indication.

Any thermally controlled devices within the enclosure shall be temperature compensated for correct operation at 85°F and above.

Space heater leads shall be stranded copper cable with 600 volt insulation and shall include terminal connectors. Space heater sheaths shall be of a corrosion-resistant, nonoxidizing material and shall have a thickness not less than 0.025 inch.

22. Wiring: In general, all devices furnished under these Specifications and requiring electrical connections shall be designed for wiring into electrical enclosures with terminal blocks. Terminal blocks shall be furnished for conductors requiring connection to circuits external to the specified equipment, for internal circuits crossing shipping splits, and where equipment parts replacement and maintenance will be facilitated.

Splices will not be permitted.

One (1) spare normally open and one (1) spare normally closed contact on each control switch and lockout relay shall be wired out to terminal blocks.

All wiring leaving an enclosure shall leave from terminal blocks and not from other devices in the enclosure.

Auxiliary equipment such as terminal blocks, auxiliary relays, or contactors shall be readily accessible. Auxiliary equipment shall be located in compartments, enclosures, or junction boxes in such arrangement that a serviceman will have direct access to the equipment without removal of barriers, cover plates, or wiring.

Terminal blocks for external connections shall be grouped in the instrument and control compartment for easy accessibility, unrestricted by interference from structural members and instruments. Sufficient space shall be provided on each side of each terminal block to allow an orderly arrangement of all leads to be terminated on the block.

Terminal blocks shall not be mounted in compartments containing cables or buses operating at voltages above 600 volts.

A shorting-type terminal block shall be installed at an accessible location for each set of current transformers supplied with the equipment furnished under these Specifications. The shorting-type terminal block shall be the one nearest the current transformers. No other shorting-type terminal blocks are required unless specified otherwise. The shorting-type terminal blocks shall be furnished with white marking strips. All electrical cables shall be conservatively selected for the electrical and environmental conditions of the installations and shall be of the best construction for the service where unusual service conditions are encountered. Proper temperature application cable shall be used throughout. Except where required to be otherwise to perform satisfactorily in the service, or unless otherwise specified in the Detailed Specifications, all electrical power

and control conductors shall be Class B, stranded copper conductors, 14 AWG or larger.

Electrical cables which utilize mineral insulation (NEC Type MI) or polyvinyl chloride (PVC) insulation (NEC Types AWM, MTW, TA, TBS, THHN, THHW, THWN, TW, or THW) shall not be utilized. PVC shall not be utilized as a jacketing material on any of the cable constructions.

Control panel and cabinet wiring shall utilize stranded copper conductors with flame retardant cross-linked polyethylene or flame retardant ethylene-propylene rubber insulation rated 600 volts and shall meet the requirements of UL 44 for Types SIS and XHHW. The cables shall also meet the UL 44 VW-1 flame test and shall be Rockbestos Type SIS, VW-1; American Insulated Wire Type SIS, VW-1; Continental Wire & Cable Type SIS, VW-1; or acceptable equal.

Preinsulated terminal connectors shall include a vinyl sleeve, color coded to indicate conductor size. Preinsulated terminal connectors shall include a metallic support sleeve bonded to the vinyl insulating sleeve and designed to grip the conductor insulation.

Ring-type connectors shall be manufactured by AMP, 3M, or acceptable equal. Spade-type connectors shall be AMP slotted spring spade or 3M Scotchlok Series 61 snap spade terminal connectors.

Each terminal block, terminal, conductor, relay, breaker, fuse block, and other auxiliary device shall be permanently labeled to coincide with the identification indicated on the drawings. All terminals provided for termination of external circuits shall be identified by inscribing circuit designations acceptable to IPSC's Contract Administrator on the terminal block marking strips with permanent black ink. All other wiring terminations shall be identified by printing on conductor identification sleeves. A conductor identification sleeve shall be provided on each end of each internal conductor. Each sleeve shall be marked with the opposite end destination identification. Conductor identification sleeves shall be PVC, not less than 1/2 inch long, and shall be as manufactured W.H. Brady Company, Milwaukee, Wisconsin, or acceptable equal. Conductor identification shall be printed on the sleeve with permanent black ink acceptable to IPSC's Contract Administrator. After inscription of the conductor identification, the sleeve shall be coated as required to prevent smudging. Conductor identification shall be permanent, unaffected by age, heat, solvents, or steam, and not easily dislodged. Adhesive labels are not acceptable.

The arrangement of connections on terminal blocks shall be acceptable to IPSC. All connections requiring disconnect plug and receptacle-type devices shall be provided with factory terminated conductors on each plug and receptacle. Plugs and receptacles shall be factory wired into junction boxes containing terminal blocks for external

connections. All conductors on the disconnect portion of plug-receptacle assemblies shall be in a common jacket.

All temporary wiring installed in the factory for equipment testing shall be removed prior to shipment of the equipment.

23. Equipment Safety Grounding: All electrical equipment that is part of an integral shipping unit or assembly shall be furnished with bare copper grounding conductor extending to a central ground connection lug. The lug shall be suitable for field connection to the station ground grid by others.

Isolated logic system or single-point ground connections required for proper operation of electronic equipment shall be insulated from the equipment safety ground. Such connections shall be extended, using insulated cable, to a single termination point suitable for field connection to the appropriate ground system by others.

Electrical equipment shall include all enclosures containing electrical connections or bare conductors with the exception of control devices, such as solenoids, pressure switches, and limit switches, unless such devices require grounding for proper operation.

24. Terminal Blocks: Terminal blocks shall be furnished with white marking strips and, where permitted by the safety codes and standards, shall be without covers. Twenty percent spare terminals shall be furnished.

All terminal blocks, except internal terminal blocks in factory prewired electronic systems cabinets and terminal blocks for thermocouple extension wire, shall be Buchanan Medium Duty, rated 600 volts, with thermocouple contacts or Marathon 200 Series with Omega Engineering, Inc., Type TL terminal lugs for terminal blocks, or acceptable equal. Terminal blocks shall be appropriately sized for larger wire size or higher voltage insulated incoming conductors as necessary.

25. Indicating Lights: Status indicating lights shall be either Micro Switch Type PTW, with Type 387 lamps, plastic lenses, and appropriately sized resistors; General Electric Type ET-16, with incandescent screw connectors, plastic lenses, and appropriately sized resistors; or acceptable equal.

Engraved indicating lights shall be Honeywell Micro Switch Series 2 with Type 387 lamps or acceptable equal.

Indicating lights shall be energized when the condition exists and shall be de-energized when the condition does not exist. Indicating light lens colors shall be coordinated with indicated conditions as specified in the following table:

Lens Color	Condition
Red	Equipment Energized, Such as Motor Running, Valve Open, or Breaker Closed
Green	Equipment De-Energized, Such as Motor Stopped, Valve Closed, or Breaker Open
White	Equipment Abnormality, Such as Motor Trip or Breaker Trip
Amber or Yellow	Equipment Start Permissive

26. Alarm Contacts: Alarm contacts for remote annunciation shall be suitable for operation at 125 volts dc. All contacts shall be rated at least 0.5 ampere make or break, at 125 volts dc. Alarm contacts shall be normally closed contacts which open to alarm condition.

27. Molded Case Circuit Breakers: Molded case circuit breakers used in equipment furnished under these Specifications shall be as listed in the following tables:

AC Service							
				Interrupting Capacity (NEMA)			
				AC		DC	
Pole	Service Volt AC	Frame Rating Ampere	Trip Range Ampere	Symmetrical Ampere	Volt	Ampere	Volt
1	120	100	15-100	10,000	120	5,000	125
2	208	100	15-100	10,000	240	5,000	250
2	480	100	15-100	25,000	480	10,000	250
3	208	100	15-100	10,000	240	**	**
3	480	100	15-100	25,000	480	**	**
2	480	225		25,000	480	10,000	250
3	480	225		25,000	480	**	**

**The construction of all 3-pole circuit breakers furnished under these Specifications shall be equivalent to 1-pole and 2-pole circuit breakers specified. This shall include heavy-duty construction and spacing between poles as required for dc rated circuit breakers.

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DC Service							
				Interrupting Capacity (NEMA)			
				AC		DC	
Pole	Service Volt DC	Frame Rating Ampere	Trip Range Ampere	Symmetrical Ampere	Volt	Ampere	Volt
2	125	100	15-100	10,000	120	5,000	125

28. Factory Prewired Electronic Systems Cabinets: Internal wiring in factory prewired electronic systems cabinets may be installed according to Contractor's standard as to wire size, insulation, and method of termination on internal equipment except that insulation for all wiring (including circuit board wiring, back plane wiring, and power supply wiring) shall meet the VW-1 (vertical wire) flame test requirements of UL 44. Interconnecting cables between devices shall meet the flame test requirements of IEEE Standard 383 (ANSI N41.10) using a gas burner flame source. The individual conductors of the interconnecting cables shall meet the flame resisting test requirements of ICEA S-19-81, Paragraph 6.19.6. Identification of conductors may be done by insulation color coding identified on drawings or by printed wiring lists. Terminal blocks for connection of external circuits into factory prewired electronic systems cabinets shall meet all the requirements of Article 24, Terminal Blocks, of this Division.

29. Solid-State Logic Systems: All electrical equipment containing solid-state logic systems shall be tested in accordance with the manufacturer's standard tests for a minimum of 120 hours under power prior to shipment from the factory. The components to be tested shall include the electronic devices, power supplies, input/output devices, operator interface devices, and interconnecting cables provided with the system. The system shall be tested as a complete assembly. Testing of individual components or modules will not be acceptable as system tests. Testing should be done at maximum operating temperature. All solid-state boards should under go a burn in phase prior to any actual tests.

    A description of the manufacturer's standard factory test procedure shall be provided in the Proposal.

30. Contractor-Furnished AC Motor Starters: The AC motor starters furnished with the equipment shall provide wiring in accordance with the following requirements:

    Motor starters for 480 volt AC service shall include 480 volt, 3-phase, 60 hertz contactors with manual reset thermal overload relays, 120 volt ac operating coils, and 480 to 120 volt dry-type control transformers complete with one secondary lead fused and the other secondary lead grounded.

PART F - DIVISION F4

ENGINEERING DATA

1. General: This Division stipulates the requirements for engineering data which Contractor shall submit to IPSC for design information and review. Compliance with the specified schedule for engineering data submittal is vital to the scheduled progress and completion of the Project.

   All engineering data shall be identified with the equipment or structure it represents by use of the nomenclature established by the Contract Documents. Equipment drawings shall have IPSC's equipment name and number clearly displayed. Material drawings shall have the engineer's structure name and structure number (when applicable) clearly displayed.

   a. Document Index: A document index listing all drawings and data to be submitted shall be included with the initial submittal. The document index shall be resubmitted as required to indicate revisions to the list. The list shall include the document number and title, if known, or the general document category, e.g., wiring diagrams for each item of equipment.

2. Review of Engineering Data: IPSC's review of engineering data will cover only general conformity of the data to the specifications and documents, external connections, interfaces with equipment and materials furnished under separate specifications, and dimensions which affect plant arrangements. IPSC's review does not indicate a thorough review of all dimensions, quantities, and details of the equipment, material, device, or item indicated or the accuracy of the information submitted; nor shall review by IPSC be construed as relieving Contractor from any responsibility for errors or deviations from the requirements of the Contract Documents.

   All engineering data submitted, after final processing by IPSC shall become a part of the Contract Documents and the Work indicated or described thereby shall be performed in conformity therewith, unless otherwise required by IPSC.

3. Performance Curves: If applicable, six (6) copies of the performance curves shall be submitted as scheduled in Division F2, General Description and Scope of Work.

4. Design Data: If applicable, six (6) copies of the design data shall be submitted as scheduled in Division F2, General Description and Scope of Work.

5. Test and Inspection Data: Certified copies of test and inspection reports shall be provided by Contractor for all tests and inspections conducted on the specified equipment. Six (6) copies of each report shall be submitted to IPSC within two (2) weeks after completion of each test or inspection.

6. Motor Information Sheets: Motor Information Sheets are included at the end of this Division. If applicable, a copy of the appropriate sheets shall be completed for each motor furnished under these Specifications. Copies of the completed sheets shall be submitted as specified in this Division and as scheduled in Division F2, General Description and Scope of Work. The number of copies submitted shall be the same as for other manufacturer's drawings.

7. Drawings: Drawings shall be in sufficient detail to indicate the kind, size, arrangement, weights of each component, breakdown for shipment, and operation of component materials and devices; the external connections, anchorages, and supports required; the dimensions needed for installation and correlation with other materials and equipment; and the information specifically requested in the drawing submittal schedule specified in Division F2, General Description and Scope of Work.

Drawings shall be fully completed and certified by Contractor as to the compliance of the information contained thereon with the requirements of these Specifications. Drawings shall have title block entries clearly indicating the drawing is certified. Drawings will be reviewed by IPSC and processed as specified in this Division.

Each drawing submitted shall be clearly marked with the name of the Project, the unit designation, the Specification title, the Specification number, the project equipment or structure nomenclature, Contractor's name, and IPSC's drawing number (after it is assigned upon initial submittal of the drawing). Catalog pages are not acceptable. If standard drawings are submitted, the applicable equipment and devices furnished shall be clearly marked. Separate drawings shall be submitted for each of the two (2) generating units.

Drawings shall be submitted in accordance with the schedule specified in Division F2.

a. Drawing Submittal: Six (6) prints of each drawing shall be submitted. Prints shall be black line on white background. Print size shall not exceed 34 inches by 44 inches unless due to the size of the equipment larger drawings are necessary. Drawings shall be folded to 8-1/2 inches by 11 inches. One (1) copy of each drawing shall be submitted in AutoCAD drawing file format.

Drawing and lettering practices shall be in general accordance with the requirements of US Department of Defense, Military Standards - Engineering Drawing Practices, DOD-STD-100C.

b. Drawing Processing: A copy of each drawing reviewed will be returned to Contractor as stipulated herein. Copies of drawings returned to Contractor will be in the form of a print with IPSC's marking.

When drawings and data are returned marked '*exceptions noted*', the changes shall be made as noted thereon, and six (6) corrected copies shall be submitted to IPSC.

When the drawings and data are returned marked '*returned for correction*', the corrections shall be made as noted thereon and as instructed by IPSC and six (6) corrected copies shall be submitted.

When a drawing is revised and resubmitted, Contractor shall include an issue number and revision description in the drawing revision block. All revisions pertaining to that particular drawing issue shall be clouded or otherwise clearly noted on the drawing.

When the drawings are returned marked '*no exceptions noted*' or '*received for distribution*', Contractor shall submit drawings for final distribution as specified hereinafter under Final Drawings. Drawings marked '*received for distribution*' have been filed; however, have not been reviewed.

No Work shall be performed in connection with the fabrication or manufacture of equipment and materials until the drawings and data therefor have been reviewed by IPSC except at Contractor's own risk and responsibility. Work may proceed on equipment and materials when the drawings and data therefor have been returned marked '*no exceptions noted*' or '*received for distribution*', and when drawings have been returned marked '*exceptions noted*', provided the Work is performed in accordance with IPSC's notations.

If changes are made to the equipment at the IPP Job Site, revised drawings indicating the changes made shall be prepared by Contractor and submitted to IPSC.

c. Final Drawings: Upon receipt, from IPSC, of drawings marked '*no exceptions noted*' or '*received for distribution*', Contractor shall transmit seven (7) additional prints of each drawing to IPSC for final distribution. However, if during the submittal process, Contractor makes further changes to drawings that have been reviewed by IPSC, the changes shall be clearly marked on the drawings and the submittal process shall be repeated.

d. Electronic File Copies: One (1) electronic copy, in AutoCAD drawing file format, of each final electrical wiring and elementary diagram for equipment shall be furnished. Electronic copies shall be submitted to IPSC on archival quality compact disks.

8. Wiring Diagrams: Connection and interconnection wiring diagrams furnished by Contractor shall be as indicated in ANSI Y14.15a-1971, Section 15-11, Article 15-11.3.2.1 and Figure 11-4 except that function information and wire run code are not

required. Each device connection shall have near each termination, indicated in breaks, conductor identification consisting of the opposite end destination. The wiring diagrams shall be drawn with all devices indicted in their relative physical locations and shall represent the equipment and terminals arranged as they would appear to a person wiring the equipment.

Wiring diagrams shall be prepared on sheets approximately 30 inches by 42 inches. Where interconnecting wiring from different items of equipment or sectional wiring diagrams of the same item of equipment appear on different wiring diagram sheets, all interconnections shall be clearly identified. Where sectional wiring diagrams are required for a single item of equipment, such as a relay panel or control panel, that section of the panel which is represented by each individual wiring diagram sheet shall be keyed on that sheet in a manner acceptable to IPSC.

Information indicated on Contractor's drawings shall include wiring of the individual panel items as they actually will appear in the panel, contact arrangements of switches, and internal wiring of relays and instruments.

Elementary diagrams shall be cross-referenced to terminal markings on the connection and interconnection diagrams; however, need not indicate complete details of circuits external to the panels. Each item of panel-mounted equipment indicated on the diagrams shall be identified by item number and name.

Sufficient space shall be left on IPSC's side of outgoing terminal blocks for adding cable color codes and circuit numbers. Color codes and circuit numbers will be added by IPSC. Contractor shall be responsible for adding the color codes and circuit numbers to its drawings after they are assigned by IPSC.

9. Instruction Manuals: Instruction manuals for the unloading, storage, installation, operation, and maintenance of the equipment shall be furnished. The number of manuals and the required time of delivery are specified in Division F2, Article 15, Schedule of Activities.

a. Content: Manuals shall include the following information specific to the furnished equipment:

Contents of Manual(s)
Table of Contents and Index Tabs
Specifications, Test Data, and Curves
Description of the Equipment
Instructions in the Methods of Receiving, Inspection, Storage, and Handling Prior to Installation

Contents of Manual(s)
Installation Instructions, Including Instructions for Any Modifications That Are Required for Existing Equipment
Operating Instructions
Maintenance Instructions
Assembly Drawings
Parts Lists
List of Acceptable Lubricants
Nameplate Information and Shop Order Numbers for Each Item of Equipment and Component Part Thereof
List of Recommended Spare Parts
List of Maintenance Tools Furnished with Equipment

The above listed requirements are minimum; however, requirements which are clearly not applicable to the equipment may be deleted. Additional information which is necessary for proper operation and care of the equipment shall also be included.

b. Binding: Each copy of the manuals shall be assembled and bound in a special binder in accordance with the following:

Binding	
Manufacturer:	Viatech Publishing Solutions 424 North Cedarbrook Avenue Springfield, Missouri 65802 Telephone: (800) 888-0823
Direct Contact:	Karen Bailey 10621 West 98th Street Overland Park, Kansas 66214 email: kbailey@viatechpub.com Telephone: (913) 894-9699 Fax: (913) 894-2505
Binder-Type:	Swing Hinge C78 Split Prong
Construction:	Stiff Binder Board
Covering:	Supported Vinyl, Skytogen Liner

Binding	
Color:	Black
Imprinting:	Foil Stamp in Accordance with Drawing Bound at End of this Division. Imprinting Color: Gold
Capacities Available:	Split Prong, Swing Hinge 2 Inches or 3 Inches as Required

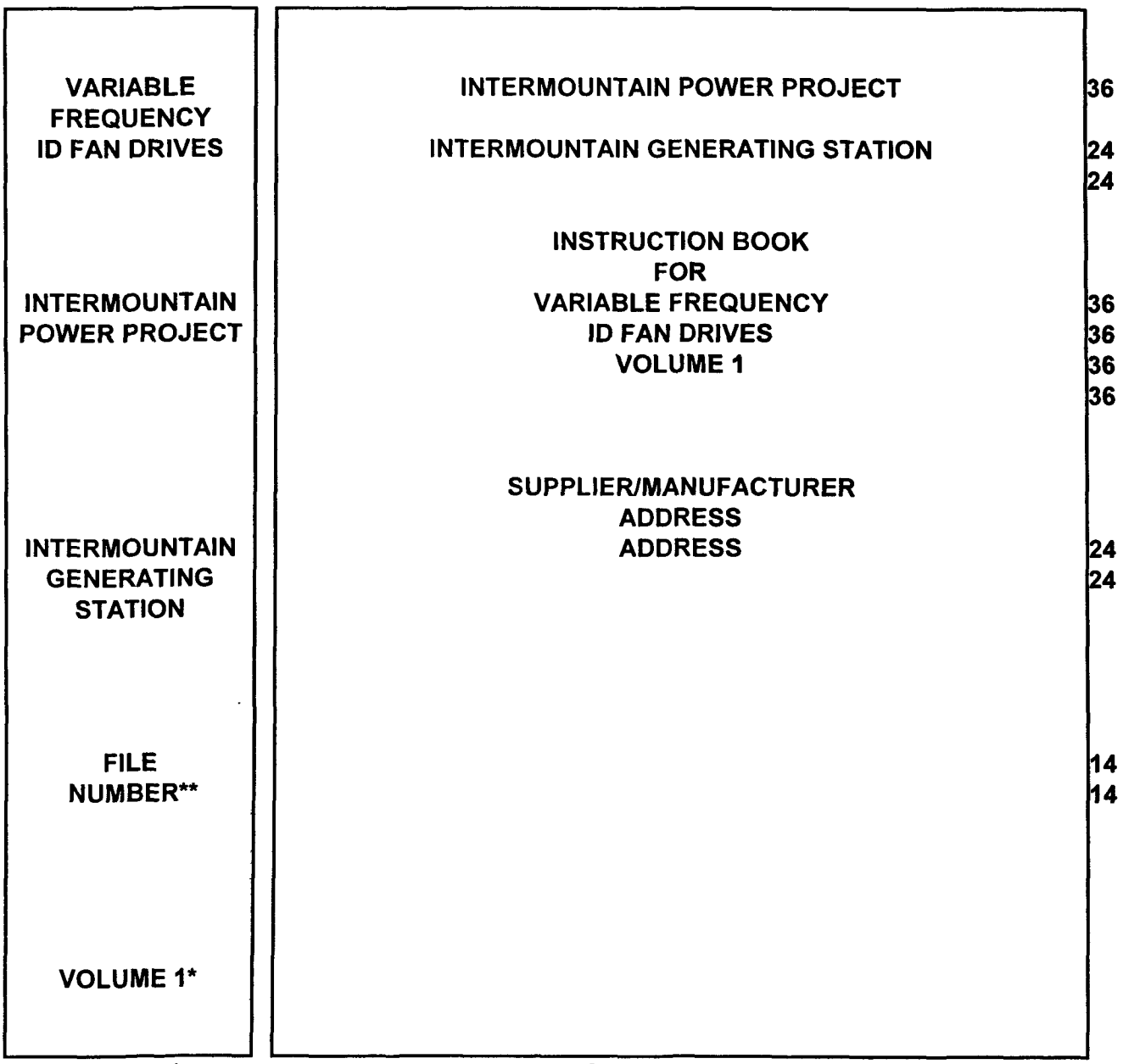
Binder capacities shall not exceed 3 inches, nor shall material included exceed the designed binder capacity. If material to be bound exceeds capacity rating, multiple volumes shall be furnished. Binder capacity should not be more than approximately 1/2 inch greater than the thickness of the material within the binder.

c. Submittal: One (1) complete "proof copy" of the proposed manual(s) shall be submitted to IPSC for review. IPSC's review will be for general conformity to specified requirements and is not intended to constitute detailed review of content.

The copy submitted for review shall be complete with binder; however, to expedite the manufacture and shipment of the binders, the binder supplier may contact IPSC directly to secure acceptance of the binder and its imprinting on the basis of the supplier's layout drawing. This will enable manufacturer to proceed without requiring the submittal of a binder proof copy.

Upon acceptance of the manual by IPSC, Contractor shall distribute the remaining copies to the addresses designated by IPSC. Separate manuals shall be provided for each of the two (2) units.

TYPICAL INSTRUCTION BOOK COVER



(Backbone) (Cover)

Notes:

1. All imprinting shall be "News Gothic" style font.
2. All backbone imprinting shall be 14-point.
3. Cover imprinting shall be point sizes indicated in column to right of cover illustration.
4. *Volume number required only if instructions are contained in more than one (1) volume.
5. **IPSC assigned file number.

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MOTOR INFORMATION SHEET (TO BE SUBMITTED WITH BID)

SHEET 1

Manufacturer				Model			
HP		Volts		Phase		Hertz	
Service Factor		NEMA Design Letter		Full-Load Speed	____ RPM		
ENCLOSURE:							
Type				Frame Size			
INSULATION SYSTEM:							
Class		Standard		Sealed		Ambient Temperature	____ °C
Temperature Rise	____ °C	By Resistance at Service Factor of 1.0: By Resistance at Service Factor of 1.15:				____ ____	
Full-Load Current	____ Amps			Locked-Rotor Current	____ Amps		
SPACE HEATER (IF FURNISHED):							
Number of Units				Unit Rating	____ Watts		
Volts				Phase			
BEARINGS:							
Type		ABMA L-10 Rating Life		Not Less Than ____ Hours			
LUBRICATION:							
Type				System			
SOUND LEVELS:							
SOUND POWER LEVEL				OVERALL MEAN NO-LOAD SOUND PRESSURE LEVEL			
Re 10^{-12} Watts ___ dBA Free Field Total Motor Weight ___ Pounds				Re 20 Micropascals (0.0002 Microbar) Reference Distance of 1 Meter _____ Reference Distance of 2 Meters _____ : dBA Free Field _____			

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MOTOR INFORMATION SHEET (TO BE SUBMITTED WITH BID)

SHEET 2

MULTI-SPEED MOTORS:					
Variable Torque		Constant Torque		Constant Horsepower	
Motor Terminal Connection Diagram Number (Attached Copy of Diagram)			No: _____		
WOUND ROTOR MOTORS:					
Sec Volts		Sec Amp		Sec Res, OHM M-M At 25°C	
MOTORS IN HAZARDOUS LOCATIONS:					
Motor Enclosure Surface Temperature Motor Enclosure Surface Temperature	_____°C _____°C		At Service Factor of 1.0 At Service Factor of 1.15		____ ____
Will Motor Contain a Surface Temperature Control Thermostat Requiring Connection Into the Motor Starter Control Circuit: Yes _____ No _____					
DUST IGNITION PROOF MOTORS:					
Motor Enclosure Surface Temperature Rise Under Any Abnormal Operating Condition Including Overload, Single-Phase, etc., Assuming Enclosure Surface Temperature of 120°C When Abnormal Condition Develops:					
Minimum Time to Reach 165°C	_____ S		Maximum Rate of Rise		_____°C IN 5 S
Additional Motor Data for Motors Larger Than 200 HP and for All Motors Rated Above					

MOTOR INFORMATION SHEET (TO BE SUBMITTED WITH BID)

SHEET 3

Additional Motor Data to be Submitted for Motors Larger than 200 HP and for All Motors Rated Above 600 Volts			
Efficiency, Percent Guaranteed, Load:	1/2 _____	3/4 _____	4/4 _____
Power Factor, Percent Guaranteed, Load:	1/2 _____	3/4 _____	4/4 _____
Minimum Starting Voltage in Percent of Rated Voltage:		Calculated: ____	Specified: ___
Octave Band Mean No-Load Sound Pressure Level Re 20 Micropascals (0.0002 Microbar)			
Reference Distance of 1 Meter: _____		2 Meters: _____	

Center Frequency Hz	Level dBC	Outline Drawing Number: _____	
31.5		Accelerating Time at Rated Voltage:	_____S
63		At Minimum Specified Starting Voltage:	_____S
125		Locked-Rotor PF:	_____%
250		Locked-Rotor Torque:	_____Lb/Ft
500		Pull-Up Torque:	_____Lb/Ft
1,000		Breakdown Torque:	_____Lb/Ft
2,000		Total Rotor Wt:	_____Lb
4,000		Rotor Inertia:	_____Lb/Ft^2
8,000		Open Cir Time Constant:	_____S
		For Vertical Motors Reed Frequency:	_____Hz

Thermal Limit Curve Under Locked-Rotor, Acceleration, and Running Overload Conditions; and Time-Current Curves During Acceleration at Rated Voltage and at Minimum Specified Starting Voltage Curve Number: _____ (Attach Curve)

Locked-Rotor Safe Stalled Time, S	Rated Voltage	Minimum Specified Starting Voltage
Motor Initially at Maximum Specified Ambient Temperature		
Motor Initially at Service Factor Load Operating Temperature		

MOTOR INFORMATION SHEET (TO BE SUBMITTED WITH BID)

SHEET 4

Additional Motor Data to be Submitted for Motors Larger than 200 HP and for All Motors Rated Above 600 Volts				
Speed-Torque-Current Curves at Rated Voltage and at Minimum Specified Starting Voltage, in Percent of Full Load or Curve Numbers ____	Rated Voltage		Minimum Specified Starting Voltage	
	Torque	Current	Torque	Current
(ATTACH CURVES)	LB-FT	AMP	LB-FT	AMP
At Speed Corresponding to Maximum Torque				
At 80% Speed				
At 60% Speed				
At Locked-Rotor				
Number of Successive Starts	AT Rated Voltage		At Minimum Specified Starting Voltage	
Motor Initially at Maximum Specified Ambient Temperature (Cold)				
Motor Initially at Service Factor Load Operating Temperature (Hot)				
Cooling Period Required After Completion of the Preceding Maximum Number of Successive Starts Before Making Additional Starts Based on the Following Cooling Conditions, Minutes				
Motor Running at Service Factor Load				
Motor Running with Driven Equipment Unloaded				
Motor De-Energized, Coasted to Stop, and Left Idle				

MOTOR INFORMATION SHEET (TO BE SUBMITTED WITH BID)

SHEET 5

Additional Motor Data to be Submitted for Motors Larger than 200 HP and for All Motors Rated Above 600 Volts						
For Motors Which Differential Protection is Specified, Stator Conn	Wye			Delta		
For Motors Requiring Integral Water Cooling of Bearing Oil						
Flow of Cooling Water Required				GPM		
Maximum Cooling Water Inlet Temperature				°C		
For Motors Connected to External Lubricant Recirculating System						
Flow of Oil Required to Motor Bearings		GPM at		°C Max at		PSI
Bearing Heat Rejection to Oil				BTU/H		
Outlet Temperature of Oil from Motor Bearings				°C Maximum		
For Horizontal Motors Rated 1,000 HP and Larger at 3,600 RPM and for all Motors Rated 3,500 HP and Larger at all Speeds						
Critical Speeds	First Critical		RPM			
	Second Critical		RPM			

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PART F - DIVISION F5

GENERAL QUALITY SYSTEM REQUIREMENTS

1. Purpose/Scope: The purpose of this supplemental document to the Technical Requirements is to establish a set of requirements pertaining to the quality of supplied equipment and commodities.

2. Quality System: It is the responsibility of Contractor to define and implement a detailed and documented quality management system which ensures that all equipment and commodities supplied are in conformance with required drawing and/or specifications and which meets all the guidelines (requirements) set forth in this document. The system shall be capable of providing assurance that design, purchasing, materials, manufacturing, examination, and testing of equipment, shipping, storage, and related services comply with the requirements of the Contract.

   Contractor quality system shall include, at a minimum, procedures or methods to ensure that the following are controlled:

Design documents , drawings, specifications, quality assurance procedures, quality records, inspection procedures, inspection and test status, and Contract Documents maintained current, accurate, and under control.
Purchased materials, equipment, and services conform to the requirements of the Contract.
Receipt inspection, in-process inspection, examination, testing, and checkouts conducted.
Shipping, storage, and preservation of equipment and commodities supplied meet Contract requirements.
Adequate inspection of subcontracted work.
Control of special processes such as welding, heat treating, hot forming, and nondestructive testing.
Proper methods employed for the qualification of personnel who are performing special processes: Welding, nondestructive examinations, coatings, etc.
Inspection, measuring, and test equipment.
Procedures that document and control the verification, storage, use, and maintenance of customer supplied product provided for incorporation into manufactured equipment or commodities.
Any applicable commercial standards (such as ANSI, AGMA, API, ASME) should also be incorporated into this system. This system shall be made available to IPSC's Technical Services Department for review upon request.

3. Quality System Manual: The quality system shall be documented in a quality system manual. One (1) controlled copy of the quality system manual shall be submitted to the IPSC's Contract Administrator's. The quality system manual shall be kept current by submittal of revisions as applicable throughout the life of the Contract.

4. Subcontractor(s): Contractor shall notify IPSC in writing prior to the award of Contract of the intention to use subcontractors. If, at the time of award of Contract, the prime Contractor does not know the name of the subcontractor(s), the prime Contractor's shall provide the name, type, and location of the subcontractor(s) and the Contractor's subcontractor(s) qualification documentation prior to award of subcontractor's work.

   Contractor shall ensure that subcontractor(s) have the capabilities to fulfill the Contract requirements. Contractor shall submit objective evidence of subcontractor(s) capabilities, processes, or in-process work involving the fabricating and manufacturing of equipment and commodities for IPSC.

   Subcontractor(s) qualification and monitoring are the responsibility of Contractor, in accordance with this supplemental specification, to ensure the same high-quality standards. When deemed necessary, IPSC has the authority to perform quality audits and inspections, and monitor and/or review subcontractor(s) processes and facilities.

5. Inspections by IPSC: IPSC may elect to perform inspections, quality audits, or witness testing at any time during the manufacturing process. IPSC may designate an authorized agent for inspections, witness testing, or quality audits. Authorized agent can be an employee of IPSC or an outside agency. When an outside agency is designated as an authorized agent for IPSC, such designation will be in writing with a copy provided to Contractor. Hereinafter, when an IPSC representative is used, it may also mean IPSC or the authorized agent.

   The following requirements shall apply for IPSC's inspection of Contractor's mill, factory, yard, or warehouse.

   a. Inspection and Test Plan: In accordance with the Division F2, Schedule of Submittals, a detailed inspection and test plan (i.e., a Quality Assurance/Quality Control Plan) for the Work shall be submitted to IPSC as specified in the Contract. The inspection and test plan is a detailed step-by-step list of operation and requirements which shall identify the inspection and testing points for major components of the Work and shall be maintained current throughout the Contract. The plan shall include Contractor's strategy for inspecting subcontractor's work, including inspection by Contractor at subcontractor's facilities. IPSC will designate any test witness points or other inspection points required.

b. Access: IPSC will have the right to inspect Contractor's and subcontractor's Work and related documents in the course of manufacture providing no delays in manufacture are caused thereby. Contractor is required to provide, at its own expense, reasonable facilities including tools and instruments for demonstrating acceptability of the Work.

c. Test Witnessing: If called for in the Contract and when designated as a hold point, witnessing of mill or factory tests must be performed in the presence of IPSC's Contract Administrator unless waived in writing by IPSC's Contract Administrator. Contractor shall bear all expense of such tests except the compensation and expense of IPSC's representative.

Contractor shall inform and notify IPSC at least ten (10) working days in advance of the appropriate times of inspections and tests, when such inspection and test points have been designated as required hold points for witnessing. The Work shall not progress past a required inspection and test point until IPSC has inspected the Work or witnessed the designated test, or waived in writing the right to perform an inspection or to witness a test.

d. Corrective Action: Upon detention of a noncompliance with the requirements of the Contract or Contractor's quality system, Contractor shall document the noncompliance issue and provide IPSC's representative a copy of the report. If Contractor does not document the noncompliance, then IPSC's representative shall issue a corrective action report to Contractor. Contractor will be required to correct, in a timely manner, all deficiencies identified.

e. Rejection: If any items or articles are found not to meet the requirements of these Specifications, the lot, or any faulty portion thereof, may be rejected. Before offering specified material or equipment for shipment, Contractor is required to inspect the material and equipment and eliminate any items that are defective or do not meet the requirements of the Contract. The fact that materials or equipment have been previously inspected, tested, and accepted does not relieve Contractor of responsibility in the case of later discovery of flaws or defects.

6. Receipt Inspection: Materials or equipment purchased under the Contract may be inspected at the specified receiving points and will either be accepted or rejected. Inspection will include the necessary testing for determining compliance with these Specifications. All expense of initial acceptance tests will be borne by IPSC. The expense of subsequent tests, due to initial test failures, will be charged against Contractor.

PART 6 - DIVISION F6

SEISMIC DESIGN REQUIREMENTS

1. General: This Division specifies the general criteria and procedures that shall be used to ensure that structures, systems, and components will meet their performance objectives during and following a seismic event.

2. Seismic Loads: Seismic loads shall be determined in accordance with applicable portions of Chapter 16, Sections 1613 to 1622 of the 2000 IBC Code. The VFD equipment is being erected in a seismically active area. The importance factor (I_E) shall be 1.5. The site class shall be "D". The spectral response acceleration at short period "S_S" shall be equal to 0.50g and the spectral response acceleration at one (1) second period "S_1" shall be 0.15g. The seismic use group shall be III.

   Contractor shall submit the seismic design calculations for review. These calculations shall indicate all assumptions and references used, and shall be subject to audit to verify that the design is in compliance with these Specifications.

PART F - DIVISION F7

MEDIUM VOLTAGE VARIABLE FREQUENCY DRIVES

1. General: This Division specifies requirements for VFDs for large 3-phase synchronous or squirrel-cage induction motors. Both current source LCIs and PWM drives are being considered.

To the extent possible, considering the application is a retrofit application, the intent is to purchase the suppliers standard equipment with needed available options. Alternate configurations will be considered. If existing synchronous motors are used, two (2) VFDs, complete with all required control components, shall be furnished for each motor. If new motors are provided, one (1) drive per motor is needed. The Project requires VFDs for eight (8) ID fan motors.

VFDs shall be manufactured and completely assembled, including the input transformer at Contractor's factory.

The VFDs shall be housed in the existing control building along with any associated cooling equipment. Contractor shall include in the Proposal the expected and maximum heat loss on a per drive basis for the VFD proposed.

Rated Capacity	10,000 HP per Fan at 1050 RPM and 8,200 HP per Fan at 954 RPM
Quantity	VFD Systems for Eight (8) Fans Total Over the Next Four (4) Years
Application	ID Fan Service
Input Voltage	Existing Transformers - 6,900 to 3,876 Volts (See Nameplate)
Nominal Frequency	60 Hz
Short-Circuit Current at Point of Common Coupling	32 kA at 6,900 Volts Symmetrical (Maximum)
VFD Equipment Enclosure	NEMA 1
Ambient Temperature	-10°C to 50°C
Speed Range	Existing 0 to 954 RPM, 0 to 1050 RPM

a. Coordination: The design of each VFD shall be coordinated with the design of the electric supply and driven equipment. Contractor shall be responsible for furnishing each VFD, for matching the motor and the drive, and for coordinating

the collection of data and the design effort to limit harmonics to the specified levels. Contractor shall be knowledgeable of the requirements specific to the loads that are powered by each VFD. Applicable VFD system options, unique to the load-type, shall be provided.

b. Nameplates: All devices mounted on the face of each drive shall be provided with suitable nameplates. Push buttons, selector switches, and pilot lights shall have the device manufacturer's standard legend plate. All other devices shall have an engraved, phenolic laminated plate, with black lettering on a white background.

c. Instruction Manuals: In addition to requirements indicated in Division F4, Engineering Data, Article 9, Instruction Manuals, for each size of VFD shall be furnished and shall include the following:

(1) Contractor's standard manuals for each size and type of bypass switch, output contactor, transformer, line reactor, and filter.

(2) Schematics, wiring diagrams, and panel drawings in conformance with construction records.

(3) Troubleshooting procedures, with a cross-reference between symptoms and corrective recommendations.

(4) Connection data to permit removal and installation of recommended smallest field-replaceable parts.

(5) Information on testing of power supplies and printed circuit boards and an explanation of the drive diagnostics.

d. Codes and Standards: It is desirable that the proposed layout of the equipment be in accordance with standards listed below; however, if due to the equipment sizing, the proposed arrangement cannot comply with any of the standards, Contractor shall list in the Proposal the variation and reason. The equipment shall be provided in full accordance with the latest applicable rules, regulations, and standards of the following:

Codes and Standards
National Electrical Code (NEC)
Underwriters' Laboratories (UL)
American National Standards Institute (ANSI)
National Electrical Manufacturers Association (NEMA)
Institute of Electrical and Electronics Engineers (IEEE)
Federal Communications Commission (FCC)

e. Acceptable VFD Systems: Contractor shall be able to demonstrate at least ten (10) years experience in manufacturing VFDs at medium voltage, to demonstrate capability to provide parts and service support. The proposed VFD system shall have been commercially available for a period of not less than two (2) years prior to the date of Contract award. Contractor shall provide at least three (3) sites and names of individuals that may be contacted in the Proposal where similar equipment has been retrofitted.

f. Experience: It is the intent of these Specifications to purchase dependable and reliable equipment offering the best performance available from current proven technology. All equipment furnished under the Contract shall, therefore, have documentation showing proof of actual operation for a minimum of two (2) years in similar service. It is also the intent of these Specifications to procure Contractor's standard system with any options required to meet these Specifications. However, any deviations from these Specifications shall be clearly identified in the Proposal Section as exceptions.

2. Performance: Each VFD system for a fan motor shall be capable of 10,000 HP output at 0.9 per unit input voltage to the VFD. Each VFD shall also be designed and constructed to meet the required performance as specified in the following:

a. Operating Envelope: Each VFD shall meet the following speed and torque requirements.

Each drive shall provide a turning gear speed of 10 percent speed. Contractor shall verify the minimum speed of 10 percent is acceptable to the motor vendor.

Each VFD shall be capable of producing a variable AC voltage/frequency output to provide continuous operation over the speed range of 10 percent to 1050

RPM. Drives shall include a software setable maximum speed limit. Each VFD shall be capable of sustained operation at 1/10 speed to facilitate checkout and maintenance of the driven equipment. As a commissioning and troubleshooting feature, each VFD power circuit shall be capable of operating without a motor connected to a VFD output.

Each VFD shall be capable of operating any new standard AC motor of equivalent rating (horsepower and speed) over the specified speed range. Each VFD shall be rated to power the motor continuously at the motor's rated nameplate horsepower multiplied by the service factor.

The controls in each VFD shall provide an adjustable maximum horsepower limit so the drive output can be matched to the existing motor (if being reused) or to a larger motor (up to 10,000 HP).

Overload torque shall be at 105 percent of full load torque.

b. Operating Range: Each VFD system shall be designed to enable fan operation over the entire operating range defined on the speed-torque curve shown in Figure 3.3, page F7-25, located at the end of this Division.

c. Input Harmonics: VFDs input harmonics shall comply with the latest edition of IEEE 519 for total harmonic voltage and current distortion limits:

(1) Voltage Harmonics: Individual or simultaneous operation of the VFDs shall not add more than 2.5 percent total harmonic voltage distortion while operating from the utility source.

(2) Current Harmonics: Maximum allowable total harmonic current distortion limits for each VFD shall not exceed 5 percent as calculated and measured at the point of common coupling.

(3) Each motor converter shall be 24 pulse or provide harmonic filters to provide equivalent harmonic performance.

(4) Compliance shall be verified by Contractor with field measurements of harmonic distortion differences at the point of common coupling with and without VFDs operating. The Point of Common Coupling (PCC) for all harmonic calculations and field measurements for both voltage and current distortion shall be defined as the main breaker feeding the 6,900 volt bus feeding the drive, based on individual motors.

(5) Power quality metering shall be installed in each VFD system to continuously monitor and display input and output power quality. The power quality data shall include the following:

(a) Input voltage (average RMS value).

(b) Input current (individual phase RMS values and average RMS value).

(c) Input frequency.

(d) Power factor.

(e) Input (kW, kvar).

(f) Input (kWh).

(g) Input current THD (average of three (3) phases).

(h) Single harmonic calculation in input voltage or current (phase A, B, or C).

(i) Drive efficiency.

(j) Motor voltage (RMS).

(k) Motor current (RMS).

(l) Motor speed (in RPM or percent).

(m) Motor flux (percent).

(n) Motor torque (percent).

(o) Drive output power (kW).

(p) Output (kWh).

d. Motor Compatibility: Characteristics of the existing ID fan motors are as follows:

Service	ID Fan
Machine-Type	Synchronous
Mounting	Horizontal
Enclosure	NEMA WPII with Filters
Insulation	Class F, Thermalastic
Temperature Rise	75°C
Standards	NEMA and IEEE
Ambient Temperature Maximum	50°C
Altitude Maximum	4,700 Ft Above Mean Sea Level
Duty	Continuous
Rated Output, HP	7,415 HP
Service Factor	1.0
Voltage, Volts/Frequency/Phase	3876 V, 63.6 Hz, 3-Phase
Speed, RPM	954
Current, amps	Two (2) Windings, 472 Full Load Amps Each When Two (2) Windings in Service; With One (1) Winding in Service, 506 Amps
Locked Rotor amps, maximum	N/A
Efficiency, Minimum (Full Load)	97 Percent
Power Factor, Minimum (Full Load)	0.9 Percent
Starting Voltage Range	VFD
Starting Capability	VFD
Running Capability	VFD
Bearings	Sleeve

Service	ID Fan
Bearing Lubrication	Forced Oil, Recirculation-Type; Each Bearing Requires 2.5 GPM at 20 Psig
Temperature Detectors	One (1) Type E Thermocouple per Bearing; Two (2) 10 OHM Copper RTDs per Winding
Windings	Copper
Vibration Detectors	Mounting Only
Terminal Box	Two (2) per Motor, Includes Three (3) Neutral Current Transformers
Space Heater	Yes
Sound Level	85 dB at 3 Ft in Accordance with IEEE 85
Tests	Copies Will be Made Available for Review
Incoming Cable	Shielded Cable in Conduit
Current Transformers	If Required
Surge Capacitors	No
Lightning Arresters	No

If the existing motors are used, each VFD system shall provide an output waveform suitable for the existing motors. Contractor shall verify equipment will not be detrimental to the motor life expectancy, which shall not be compromised in any way by operation with a VFD system. Each VFD shall provide motor overload protection in any operating condition.

The system design shall not have any inherent output harmonic resonance in the operating speed range.

Each VFD output shall be tuned to minimize electrically induced pulsating torque to the output shaft and the mechanical system. Contractor shall be responsible for damage to the existing motor, coupling, and fan due to torque pulsations. Contractor shall repair and/or replace items damaged at no cost to IPSC.

Existing input transformers and reactors may be used if adequate for the service. New transformers and reactors shall be provided if existing transformers and reactors are not adequate.

e. VFD System Efficiency: Guaranteed minimum total VFD system efficiency (ηsys) shall be a minimum of 96 percent at 100 percent speed and 100 percent load, and a minimum of 95 percent at 80 percent speed and 50 percent load. Efficiency evaluation shall include input transformer, harmonic filter, power factor correction (if applicable), VFD converter, and output filter, as indicated below. Auxiliary controls, such as internal VFD control boards, cooling fans, or pumps shall be included in all loss calculations.

The efficiency of a VFD system shall be calculated as follows:

ηsys = ηVFD x ηxfmr x ηpfc x ηharm x ηfilt	
Converter/Inverter (VFD)	ηVFD
Input Transformer	ηxfmr
Power Factor Correction	ηpfc
Input Harmonic Filter	ηharm
Output Filter	ηfilt

Total VFD system efficiency (ηsys) shall be 96 percent at full load and 95 percent at 50 percent load.

A penalty ($1,275 per kW) shall be assessed if efficiency is not achieved and shall be deducted from the Contract price.

f. System Input Power Factor: Each VFD system shall maintain a 95 percent minimum true power factor from 30 percent to 100 percent of rated speed. Contractor shall supply a power factor correction system, if required, to meet this requirement. The power factor correction unit shall include a separate input isolating contractor with fuses, power factor correction grade capacitors (voltage class shall be consistent with each VFD system input voltage), and series harmonic decoupling reactors, all integrated into the VFD system and mounted within each VFD enclosure. A penalty ($50 per kVAR) shall be assessed if power factor is not achieved and shall be deducted from the Contract price.

g. Speed Control System: The speed control system shall be designed to be compatible with the IPSC-furnished plant control system. The speed control system, shall also be in accordance with the paragraphs which follow.

The speed control system shall provide linear speed control corresponding to IPSC-furnished 4-20 mA (linear from 0 to 100 percent) speed control signal. Dynamic speed control range shall be 0 to 100 percent. Steady-state speed control range shall be 10 to 100 percent. The speed control shall be capable of setting the motor speed to an accuracy of plus or minus 1 percent of the test block speed of the fan.

A change in IPSC-furnished speed control signal shall not initiate a drive system acceleration or deceleration torque command unless the IPSC-furnished speed control signal changes by a field adjustable amount.

The range of this field adjustable amount shall be from plus or minus 0.5 percent to plus or minus 5 percent of full speed.

The speed control system shall be inherently stable when the IPSC-furnished speed control signal is in a steady-state condition. The speed control system shall automatically adjust rectifier SCR firing to maintain motor speed to compensate for motor load changes and 6,900 volt bus voltage changes. Changes in motor load and 6,900 volt bus voltage shall not initiate acceleration or deceleration torques. Steady-state speed control shall be within plus or minus 1 rpm without encoder or tachometer feedback.

It is expected that during starting of other large motors, the 6,900 volt bus voltage will drop momentarily to as low as 5,400 volts. This condition shall not affect motor speed as long as sufficient current, up to current limit, is available in relation to supply voltage to maintain motor speed. If insufficient current is available to maintain drive speed, the current applied shall be the current limit. The speed control system and all components of the ID Fan Variable Frequency Drive shall be capable of sustaining this condition for a minimum of 30 seconds after which coasting of the motor will be permitted. Normal control shall be initiated as soon as the 6,900 volt bus voltage reaches 6,600 volts. Speed control should resume once motor is out of current limit.

During certain times the input voltage will drop to 70 percent of its rating, motor coasting shall be initiated. Normal control shall be initiated as soon as the 6,900 volt bus voltage reaches 6,600 volts.

The electric adjustable speed drive systems shall be suitable for continuous operation at turning gear speed for equipment cool-down. Proposed information shall describe operation at turning gear speed.

h. Sound Level: Maximum allowable audible noise from a VFD system shall be 75 dB(A) at a distance of 1 meter (3.3 feet) at any speed or load condition. VFD systems with audible noise in excess of the limit shall be provided with sufficient noise abatement treatment to reduce the sound pressure level below 75 dB(A).

3. Design Calculations:

a. Torsional Analysis: The price of a torsional analysis shall be included in the base price. A deduction shall be included in case IPSC chooses not to have a torsional analysis. The total rotating system shall be analyzed to determine its natural resonant frequencies. Stresses shall be calculated for elements of the rotating system, utilizing torsional excitation data from the drive and driven system, taking into account potential fault conditions and appropriate amplification and damping factors of the rotating system. A written report on the analysis, which details the procedures used and the assumptions that were considered, shall be provided. The results of the analysis shall be presented in both detailed and summary form. Specific data presented shall include the following:

(1) A diagram of the frequencies of the torque pulsations and the mechanical resonant frequencies showing the coincident points.

(2) A plot of total shaft stress versus operating speed for the most highly stressed areas of the rotating system.

(3) A diagram of the rotating system model and mode shapes for resonance(s) of interest.

(4) Tables summarizing total calculated stresses for each element of the rotating system at operating speeds where interference(s) exist between torsional excitations and torsional resonance.

(5) Details of the rotating system used in the analysis, including the specified or a recommended alternate coupling. If a new coupling is required, Contractor shall furnish it.

(6) Recommendations for any modifications to the proposed system, if indicated by the analysis to be advisable, the cost of which shall be borne by Contractor.

b. Harmonic Study: A preliminary harmonic analysis shall be performed. A power system short-circuit ratio of twenty shall be assumed, with all VFDs operating at maximum speed and maximum load. Short-circuit current (ISC) utilized for harmonic analysis calculations is defined as:

I_{SC} = 10 * (Sum of Total Full Load Amps of All Vfd Systems)

Contractor shall submit the harmonic analysis at the time of bid, which includes all voltage and current harmonics up to the forty-ninth.

4. Availability:

a. Firing Signals: All internal firing signals, and other communications (which link operational controls with power components such as status and diagnostic signals) shall meet noise immunity and safety requirements as defined by applicable IEEE Standards.

b. Failed Switch Bypass/Ride-Through Capability: The failure of any power switching device (SCR, GTO, diode, IGBT, IGCT, etc.) or switching device control shall not result in a process trip and shall allow for continued operation of each VFD system. Either N-1 or cell bypass is acceptable. In the event of a device or device control failure, a VFD shall annunciate and identify the specific location of the failed device and allow for continued operation until such time as repairs can be scheduled. The failure of any power switching device (SCR, GTO, diode, IGBT, IGCT, etc.) or switching device control shall not result in a channel trip and shall allow for continued operation of each VFD system with both channels in service. If one (1) channel does trip, Contractor shall state this in the Proposal.

c. Power Interrupt Ride-Through: Each VFD system shall be capable of continuous operation in the event of a power loss of 5 cycles or less.

Each VFD system shall be capable of automatically restarting in event of a loss of power. Each VFD system shall provide IPSC with the choice of automatically restarting or not. The choice will be selected by the operator and retained by the control system until changed by the operator. IPSC will be able to selectively apply this feature and have the ability to set the allowable restart time applicable

to some (but not necessarily all) conditions as determined by IPSC to be appropriate for the specific application.

d. Power Sag Ride-Through: Each VFD system shall be capable of continuous operation with a 30 percent voltage sag on the input power line.

e. "Catch-A-Spinning-Load" Capability: Each VFD system shall be able to catch and take control of a spinning load if started while rotating equipment is already spinning. Appropriate safeguards shall be included in this operation to prevent damaging torque(s), voltages, or currents from impacting any of the equipment. IPSC shall have the option of employing this feature or disabling it.

f. Auto Restart Capability: Each VFD system shall be capable of automatically restarting in the event of an undervoltage trip. Each VFD system shall provide IPSC with the choice of automatically restarting or not. IPSC shall be able to selectively apply this feature to some (but not necessarily all) conditions as determined by IPSC to be appropriate for the specific application.

g. Ground Fault Withstand: In the event of a ground fault, a VFD shall be capable of annunciating the ground fault condition, safely operating and, by IPSC selection, either trip or continue operation. As a result of a ground fault trip, a VFD shall be capable of being reset and begin operating normally again after the ground fault condition has been corrected. There shall be no risk of fire or electric shock as a result of the ground fault.

5. Serviceability/Maintainability:

a. Front Access: It is preferred that each system of channel be designed for front access only. Contractor shall state in the Proposal if rear or side access is required. An explanation of reason for any required rear or side access shall be given.

b. Power Component Accessibility: All power components in the converter sections shall be mounted on a swing frame or rack-out for ease of maintenance and to minimize repair downtime. Alternate access options shall be described in the Proposal for the IPSC Contract Administrator's review and evaluation.

c. Voltage Isolation: All low voltage components, circuits, and wiring shall be separated with physical barriers from any sources of medium voltage.

d. Remote Diagnostics: Each VFD system shall be provided with the capability for remote diagnostics via modem communication or Ethernet link.

e. Marking/Labeling: Sleeve-type wire marker tags or other acceptable means of permanent identification shall be applied to power and control wiring. Individual nameplates shall be provided for all major components of a VFD system.

f. Mean Time to Repair (MTTR): The VFD design shall demonstrate an actual mean time to repair of less than 15 minutes in the event of any power switching component failure.

6. Physical Requirements:

a. Environmental Requirements: Each VFD system shall be capable of continuous operation in an average ambient temperature between -10°C and 50°C at an elevation up to 4,700 feet above mean seal level without derating. Each VFD system shall also be simultaneously suitable for continuous operation in a maximum humidity between 0 and 95 percent non-condensing.

b. Heat Dissipation/Cooling System: Each VFD system shall be air cooled unless air cooling is unavailable or impractical, in which case, liquid cooling shall be provided. The existing system is air cooled and it is desirable to reuse the existing system. If liquid cooling is required, Contractor shall furnish the heat exchangers and all mounting material and hardware to accommodate the exchangers.

c. Air Cooling Requirements: Air cooled VFDs shall be provided with 100 percent fan redundancy and automatic switch over in the event of a fan failure for enhanced reliability. If a fan fails, the system shall automatically switch to the alternate fan and generate an alarm to notify operator of initial fan system failure. The drive shall have ability to detect failed operation of initial fan system. (Using temperature detectors as the only protection against loss of fan system is not acceptable.) During normal operation, the system shall periodically cycle between the two (2) fan systems to "exercise" the systems and prevent drying out of bearings, seals, etc., and to ensure availability of all systems. Contractor shall provide, with the Proposal, heat dissipation data necessary to verify existing HVAC systems or design new HVAC systems.

d. Liquid-Cooling Requirements: Liquid cooled VFDs shall be provided with 100 percent redundant pumps and heat exchangers with automatic switch over in the event of a pump or heat exchanger failure. Redundant systems shall be provided so a cooling system can be taken out of service for maintenance or repair without taking a drive out of service.

The system shall be arranged for an external liquid-to-air heat exchanger for mounting on a deck engineered, designed, and furnished as a complete system by Contractor.

A minimum of 90 percent of the heat generated (losses) by the drive system shall be removed through the liquid cooling system. Contractor shall provide heat dissipation data necessary to design all auxiliary cooling systems and utilities. The system shall be designed so a failed pump can be safely isolated and repaired while a VFD system remains in service. Cooling pump motors shall have sealed bearings for a long, maintenance-free life.

Liquid-to-air heat exchangers shall be furnished by Contractor. IPSC will furnish piping, power, and control wiring between each VFD and the heat exchanger. The cooling system shall be filled following installation of the drive. Coolant liquid shall be furnished by Contractor.

The cooling system shall consist of two (2) circuits. One (1) internal circuit where deionized water is used and one (1) exterior circuit where propylene glycol is used to provide an ambient service temperature range of -35°C to 50°C. Ethylene glycol is NOT acceptable due to environmental and hazardous material concerns.

Quick disconnect fittings shall be provided at each connection between the header and the supply hose.

Dissimilar metals shall be completely avoided in cooling liquid piping. Plastic piping is not acceptable. The use of threaded connections shall be minimized. All connections and fittings shall be designed based upon the system cooling fluid and the required flow, and shall be tested at two (2) times the normal system design operating temperature and pressure.

Each VFD cooling system shall maintain system coolant temperature within a safe minimum and safe maximum temperature to avoid thermal shock and/or condensation.

e. Enclosure: All VFD system components, including transformer (for PWM drives), shall be mounted and wired by Contractor in a grounded enclosure meeting the following requirements without exception.

Input filters, transformer, power conversion, output filters and auxiliary equipment enclosure sections shall be NEMA 12 design. Air cooled units shall be NEMA 12 Ventilated, with gasketed doors. Liquid cooled units shall be NEMA 12 Non-

ventilated. Air cooled units shall have changeable filters covering all air inlets. Filters shall be front replaceable (for replacement) while each VFD is in operation without exposing maintenance personnel to any of the power components. Microprocessor and control logic boards and power supplies shall be housed in a sealed, non-ventilated NEMA 12 section, safely accessible without exposure to high voltages and without drive shutdown. All low voltage wiring shall be fully isolated from medium voltage compartments by metal barriers.

Cabinets and doors shall be fabricated using heavy gauge steel (12 gauge minimum) for sturdy construction and dimensional integrity to ensure long-term fit and function. All doors shall be gasketed to provide environmental protection and secure fits.

Enclosures shall be designed to avoid harmonic and inductive heating effects. The enclosure shall be designed to shield any outside equipment form interference, enclosing, and shielding the complete component to eliminate any radio frequency interference in compliance with FCC Part 18 requirements.

f. Installation/Cabling: IPSC will set the VFD equipment in place and install interconnecting wiring. Contractor's Proposal shall include a detailed description of installation requirements.

g. Space Limitation - Footprint: Contractor shall provide a proposed layout of equipment with the Proposal. Floor plans of all existing control buildings are included.

h. Interlocks: Mechanical key interlocks shall be provided on all doors. Interlocking shall be fully coordinated to prevent access to all high voltage compartments, including transformer, filters, or any switchgear that is part of the supply, when line power is applied to each VFD system. Interlocks shall be mechanical to provide positive lockout prevention and safety. Electrical interlock switches alone are not acceptable due to the possibility of inadvertent shutdown and the ease with which such switches could be bypassed.

i. Control Power and UPS System: Contractor's Proposal shall include a detailed description of control and accessory power requirements for the proposed system.

j. Space Heaters: The power/control assembly including individual compartments shall be provided with space heaters to prevent condensation of moisture within the enclosures. The heaters shall be spaced away and thermally insulated from any painted surfaces.

Space heater capacity shall be as required to maintain the compartment internal temperature above the dew point.

Voltage normally applied to the space heaters is 120 volts AC. Space heater voltage rating shall be 120 volts AC.

IPSC will provide a 2-wire, 120 volt, 60 hertz space heater supply feeder to each assembly. Contractor shall provide all required internal wiring and suitable branch circuit protection for each space heater circuit.

All space heaters shall be controlled by an adjustable thermostat, factory set to close at 85°F (ON) and to open at 95° F (OFF).

7. Protective Devices/Diagnostics:

a. Power Component Protection: Each VFD system shall include intermediate class surge arresters to protect the input transformer and VFD against voltage surges.

Each VFD system shall include protection to the converter rectifier devices to protect the secondary of the transformer from any potentially harmful fault currents. Arrangements that involve coordinated protection with an input circuit breaker are not as desirable and, if proposed, Contractor shall furnish all coordinating elements, including the circuit breaker and a detailed description of the protection scheme with the Proposal.

b. Protective Features and Circuits: The controller shall include the following alarms and protective features:

Alarms and Protective Features
Static Instantaneous Over-Current and Over-Voltage Trip
Under-Voltage and Power Loss Protection
Over-Temperature Protection
Electronic Motor Inverse Time Over-Load Protection
Motor Over Speed

Each VFD system shall be protected from damage due to the following, without requiring an output contactor:

1-Phase Fault or 3-Phase Short Circuit on VFD System Output Terminals
Failure to Commutate Inverter Thyristor Due to Severe Overload or Other Conditions
Loss of Input Power Due to Opening of VFD Input Disconnect Device or Utility Power Failure During VFD Operation
Loss of 1-Phase of Input Power

c. Data Displays: A door-mounted LCD display shall be furnished, capable of displaying VFD operational status and drive parameters. The digital display shall present all diagnostic message and parameter values in plain language engineering units when accessed, without the use of codes.

As a minimum, the following door-mounted digital indications shall be supplied:

Door-Mounted Digital Indications
Speed Demand in Percent
Actual Speed
Input Current in Amperes
Output Current in Amperes
Output Frequency in Hertz
Input Voltage
Output Voltage
Total 3-Phase kW Output
Kilowatt-Hour Meter
Elapsed Time Running Meter

d. Diagnostics and Fault Recording: The control logic section shall be fully digital and not require analog adjustment pots or fixed selector resistors.

Fault log data storage memory shall be stored in nonvolatile memory or be supported by a UPS size to provide a minimum of 48-hour data retention.

Each VFD shall include a comprehensive microprocessor based digital diagnostic system, which monitors its own control functions and displays faults and operating conditions.

A '*Fault Log*' shall record, store, display, and print, upon demand, the following for the fifty (50) most recent events:

Fault Log
VFD Mode (Auto/Manual)
Date and Time of Day
Type of Fault
Reset Mode (Auto/Manual)

A '*Historic Log*' shall record, store, display, and print, upon demand, the following control variables at an adjustable time interval for the fifty (50) intervals immediately preceding a fault trip and one-hundred (100) intervals following such trip:

Historic Log
VFD Mode (Manual/Auto/Inhibited/Tripped/Etc.)
Speed Demand
VFD Output Frequency
Demand (Output) Amps
Feedback (Motor) Amps
VFD Output Volts
Type of Fault
Drive Inhibit (On/Off)

The fault log record shall be accessible via a fiber-optic link as well as line-by-line on the keypad display.

Two (2) laptop PCs, a printer, and a "Windows 95" or newer based graphical tool suite shall be provided with the VFDs. This graphical PC tool shall be able to plot and display **up to eight (8)** different VFD parameters and have the ability to freeze plotting and print hard copy versions of the plots. Capability to display at least eight (8) different VFD system parameters is required, and all parameters displayed on the PC tool shall be synchronized with the standard keypad display.

8. Programming and Communications:

a. User Input/Keypad: The door of each unit shall include a manual speed device, a mode selector marked '*Manual/Automatic*', a '*Power On*' light, a VFD '*Fault*' light, a VFD '*Running*' light, a start push button, a stop push button, and a reset button.

A door-mounted keypad with integral digital LCD display shall be furnished, capable of controlling a VFD and setting drive parameters. The display shall present all diagnostic messages and parameter values in standard engineering units when accessed, without the use of codes. The keypad shall allow the operator to enter exact numerical settings in standard engineering units. A plain language user menu (rather than codes) shall be provided in software as a guide to parameter setting.

Drive parameters shall be factory set in non-volatile EEPROM registers and resettable in the field through the keypad. Multiple levels of password security shall be available to protect drive parameters from unauthorized personnel. The EEPROM stored drive variables shall be able to be transferred for programming of new or spare boards. System shall allow programming changes while in service.

The keypad module shall contain a "self test" software program that can be activated to verify proper keypad operations.

Each VFD system shall have the user selectable option of programming up to three (3) speed avoidance bands. This gives the user the ability to block out and prevent operation at any undesirable speed, such as one (1) that may be coincident with a mechanical resonance condition.

b. Hard-Wired Communication: Contractor shall provide five (5) additional analog, ten (10) additional digital inputs, and ten (10) additional digital outputs for connection to IPSC's plant control system for each VFD drive. All trip and start commands from IPSC's plant control system shall be hard wired. A listing of the existing hard-wired control signals is included at the end or this Division. A copy

of the existing schematics will be provided to Contractor after the Contract is awarded.

Contractor shall provide drive-to-drive communications and coordination of drives associated with each boiler. Certain parameters of this feature may be controlled by the operator.

c. Serial Communication/Protocols/Modem or Cable: VFD shall be capable of direct communication to an IBM or compatible computer via fiber-optic link for setup of parameters, fault diagnostics, trending, and diagnostic log downloading. VFD parameters, fault log, and diagnostic log shall be downloadable for hard copy printout via the fiber-optic link and the standard serial printer.

Each VFD shall be provided with single port digital communication capability to allow status communication with the IPSC plant control system. Modbus communication protocol shall be provided.

An Ethernet communications link shall be provided for future use.

9. Component Requirements:

a. Printed Circuit Boards: All printed circuit boards shall be new and coated for moisture and chemical resistance, in addition to, any dielectric coating properties. All boards shall be tested in accordance with Division F2.

b. Power Bus and Wiring: Main power bus shall be high-conductivity copper and plated for chemical and corrosion resistance and low losses. The bus shall be appropriately sized for the VFD continuous current rating and braced to withstand the mechanical forces caused by a momentary short-circuit current of 32 kA at 6900V. All connections shall be bolted or continuously welded.

c. Ground Connection: Corrosion-resistant grounding pads shall be provided in each power cubicle. A copper ground bus shall be provided for grounding of control circuits.

d. Input Isolation Transformer: Each VFD system shall use a drive isolation transformer to provide common mode voltage protection and phase shifting. The existing input transformers may be used if adequate. If new transformers are proposed, the transformers shall be as specified in Division F8.

e. DC Link Inductors: DC link inductors, if required, shall be air core to prevent saturation. Separate inductors (split dual winding-type) shall be provided in the

positive and negative legs of the DC link to minimize stray magnetic fields. Maximum temperature rise shall not exceed 115°C with a minimum 220°C insulation and over-temperature protection. To minimize cabling costs, the inductors shall be integral to each VFD system lineup. If it is not possible to integrate the inductors into each VFD system enclosure, the cabling and connecting shall be entirely furnished by Contractor, and approved by the IPSC Contract Administrator. Inductors shall meet the requirements of ANSI C57.16 and shall be designed to prevent saturation under maximum fault current conditions.

f. DC Link Capacitors: Capacitors used in the converter DC link shall be integral to each VFD system lineup to minimize cabling costs.

Capacitors used in the converter DC link shall contain discharge resistors and shall be capable of reducing the residual charge to 50 volts or less within five (5) minutes after the capacitor is disconnected from the source of supply.

g. Input Harmonic Filters: If after meeting the requirements of Division F7, Medium Voltage Variable Frequency Drives, harmonic filters are still required to meet power factor requirements, stricter local requirements, or telephone interference factor restrictions, Contractor shall provide the filter, upstream filter isolation, protection, and protection coordination. As harmonic filters are power system dependent, Contractor is responsible for maintaining and providing any required upgrades required during the warranty period at no cost to IPSC. To minimize cabling costs, the harmonic filter components shall be integral to each VFD system lineup, but isolated from other components so the components can be disconnected from the power source and accessed for maintenance/repair while each VFD is in operation. If it is not possible to integrate the filters into each VFD system enclosure, the cabling and connecting shall be entirely furnished by Contractor, and approved by the IPSC Contract Administrator. Harmonic filters shall be located on the primary side of the input isolation transformer and shall be switchable with the VFD, to prevent filters remaining on the power line in the event of a VFD trip, which could create a damaging leading power factor condition. The complete filter shall have independent protection for over-current, phase differential, and ground fault.

Any inductors used shall be iron core or air core with a maximum temperature rise of 115°C with minimum 220°C insulation and over-temperature protection. Reactors shall be designed to prevent saturation under maximum fault current conditions. Reactors shall meet the requirements of ANSI C57.16.

Capacitors used in the harmonic filter banks shall meet the requirements of IEEE 18 and IEEE 1036 for shunt power capacitors. Capacitors used in any harmonic filter banks shall be provided with a method of shorting the phases to ground once power has been removed and the capacitors have been discharged to a safe voltage level.

h. Output Filters: If an output filter is required to meet the output harmonics requirements of these Specifications, or to meet any special requirements of the application, the filters shall be fully incorporated into each VFD system design. To minimize cabling costs, the output filter components shall be integral to each VFD system lineup. If it is not possible to integrate the output filters into each VFD system enclosure, the cabling and connecting shall be entirely furnished by Contractor, and approved by the IPSC Contract Administrator.

Any inductors used shall be iron core with a maximum temperature rise of 115°C with minimum 220°C insulation and over-temperature protection. Reactors shall be designed to prevent saturation under maximum fault current conditions. Reactors shall meet the requirements of IEEE C57.16.

i. Capacitors: Capacitors used in the harmonic filter banks shall meet the requirements of IEEE 18 and IEEE 1036 for shunt power capacitors. Capacitors used in any harmonic filter banks shall be provided with method of shorting the phases to ground once power has been removed and the capacitors have been discharged to a safe voltage level.

Where potential exists for self-excitation between the output filter and the motor system, a fully (voltage and current) rated output contactor shall be provided by Contractor as part of each VFD system delivery.

j. Input Power Terminations: Input and output power connections shall be made to isolated, supported, and plated bus strap connections. Sufficient space shall be provided for termination connections from the top or the bottom of each VFD cubicle. Space provisions shall be provided for application of standard stress cones, and provisions shall be provided for grounding of shielded cabling.

10. Output Contactor or Switchgear: Each VFD output section shall contain a suitably rated load break disconnect switch interlocked with the door. The switch shall isolate a VFD for maintenance and service. For safety, blade position shall be visible through the door. The disconnect switch shall be integrated into each VFD system so as to appear as a single integrated package. The switch shall be electrically interlocked with a contact from the drive input circuit breaker to prevent the switch from changing positions while the input circuit breaker is closed. The switch shall consist of dead front,

completely metal enclosed vertical sections containing isolation switches or breakers. The door shall be interlocked with the switch so that: (a) The switch must be opened before the door can be opened; and (b) The door must be closed before the switch can be closed. There shall be a provision for padlocking the switch in either the open or closed position. The switch shall have permanent "open" and "closed" switch position indicators. The switch shall have a quick-make, quick-break mechanism providing isolation. Insulating barriers shall separate each phase and between the outer phases and the enclosure. All switches shall comply with ANSI C37.20.3, ANSI C37.22, ANSI C37.57, ANSI C37.58, NEMA SG5, and UL Standards.

11. Testing: A no load test shall be performed on the system. The drive shall be connected to an unloaded motor and feed back signals shall be verified. Output voltage shall be calibrated. All logic and interlocks, including customer logic and instrumentation, shall be tested.

The drive shall be given a full power test at rated current and rated voltage (simultaneously) for a minimum of four (4) hours (or until all system temperatures stabilize, whichever is longer). The test shall be performed as an integrated system, including all supplied input switchgear, input transformer, input filter (if supplied), power section, and output filter (if supplied). Contractor shall perform the factory system test to verify total system efficiency, power factor, and harmonic distortion limits are met as specified. Total system efficiency shall be measured using watt meters or Multilin PQM or approved equivalent meters on both the input and output of the complete system. System shall not be shipped unless performance criteria are met. Certified test data of all tests conducted shall be provided with final documentation.

The testing may be witnessed by the IPSC Contract Administrator. A projected test schedule and a copy of proposed test procedures shall be provided at least one (1) month in advance of test date. The IPSC Contract Administrator shall be given at least one (1) week prior notice or confirmation of actual test date(s).

12. Delivery: The VFD system shall be delivered to the IPP Job Site preassembled and wired with all specified interconnecting wiring and cable. Cabling for connection across shipping splits shall be neatly coiled and identified. Exposed sections of equipment shall be fully protected from damage during shipment. All necessary hardware for reconnecting shipping splits shall be provided.

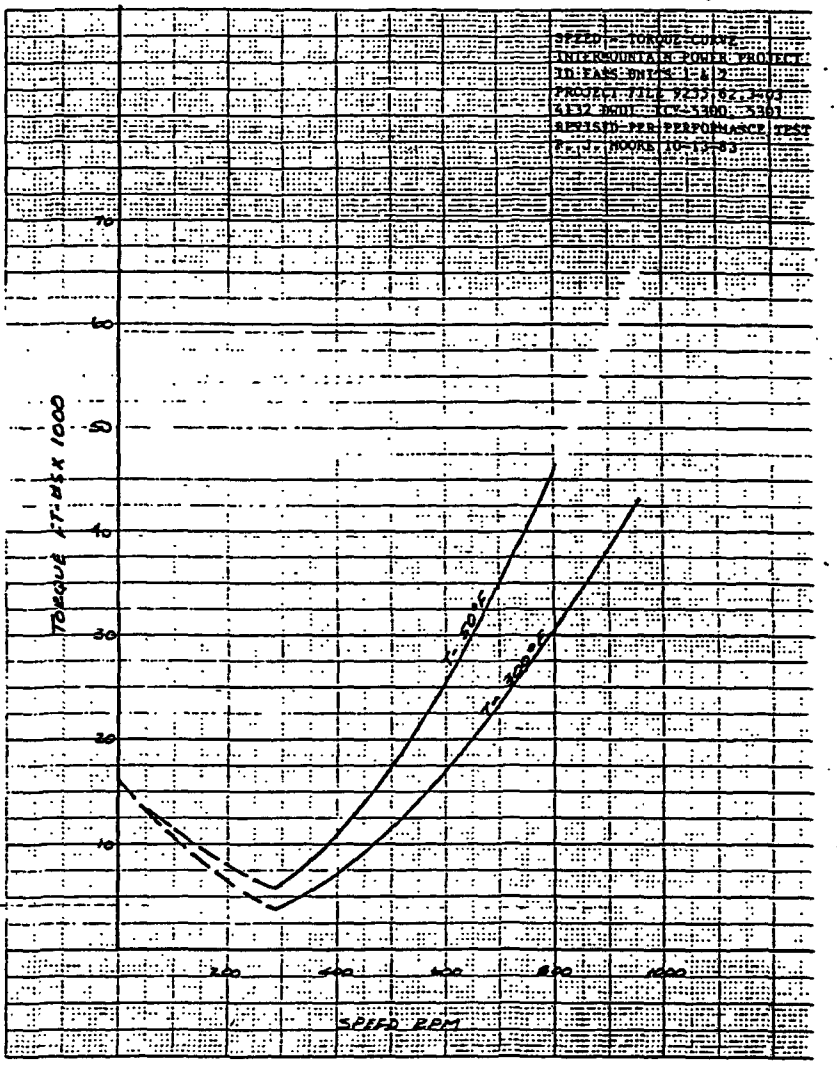
Setting equipment in place, aligning, and anchoring will be done by others. Contractor shall supervise all system interconnections across shipping splits at the IPP Job Site. Complete instructions for handling and storage shall be provided prior to delivery of the equipment. All equipment shall have adequate provisions for handling by overhead crane or forklift.

13. Training: Contractor shall provide an on-site training school for IPSC Operations, Maintenance, and service personnel (fifteen [15] total). The training school shall include classroom discussion on the theory of operation of the equipment, as well as maintenance and service methods for the purchased equipment. Topics covered shall include, safety, hardware layout and functions, power and control wiring, diagnostic indicators, keypad/display interface, software mapping, programming, setup, configuration, control loop tuning, operational indicators, faults, diagnostic tools, troubleshooting, and preventative maintenance. Hands-on training shall be provided on equipment of the same design as the equipment provided. Documentation shall be provided and shall include actual manuals for the equipment and drawings and schematics of equipment supplied for the Project. IPSC reserves the right to video tape all training sessions.

14. Startup: Contractor shall provide the field services of a factory technician as necessary to supervise/inspect installation, test, and startup all equipment provided as part of the fixed price proposal. The firm price shall include all travel and living expenses in addition to the start-up engineer's time required to complete supervision of the installation, testing, and startup as indicated in Division F2. All equipment required for testing, startup, and performance verification shall be provided by the start-up technician. Contractor shall furnish all required start-up spare parts.

    Verification of VFD input harmonic voltage and current distortion limits specified shall be verified at rated speed and rated power as part of final startup and acceptance. A recording-type Fluke, Multilin PQM, BMI, or equivalent harmonic analyzer displaying individual and total harmonic currents and voltages shall be utilized.

	SYSTEM DESCRIPTION	FILE NO. 9255.93.1405
RV	INDUCED DRAFT (CCE)	IPP 121284-1



INDUCED DRAFT FAN
SPEED-TORQUE CURVE
FIGURE 3-3

IP7_024725

Existing Hardwired Control Signal List - One (1) ID Fan Variable Frequency Drive						
Device	**Type**	**Switch**	**Description**	**Power Source**	**Point Name**	**Signal**
Contactor	DI		Induced Draft Fan Contactor 1A2 Closed	ID Fan 1A Remote I/O Power	10234	120 VAC
Contactor	DI		Induced Draft Fan Contactor 1A1 Open	ID Fan 1A Remote I/O Power	10235	120 VAC
Contactor	DI		Induced Draft Fan Contactor 1A2 Open	ID Fan 1A Remote I/O Power	10233	120 VAC
Contactor	DI		ID Fan Cont 1A1 Disconn Key SW Permit To Close Bkr	Field Power		125 VDC
Contactor	DI		SWGR Power OFF (Green Light)	Field Power		125 VDC
Contactor	DI		ID Fan Feeder Bkr Trip Push Button	Field Power		125 VDC
Contactor	DI		Induced Draft Fan Contactor 1A1 Closed	ID Fan 1A Remote I/O Power	10236	120 VAC
Contactor	DI		ID Fan Feeder Bkr Door Switch	Field Power		125 VDC
Contactor	DI		Swgr Power On (Red Light)	Field Power		125 VDC
Contactor	DI		ID Fan Cont 1A1 Disconn Key Sw Trip Surge Bkr	Field Power		125 VDC
Motor	AI	TE-946	ID Fan 1A Motor Inbd Bearing Temperature			4-20 MA
Motor	AI	TE-681	ID Fan 1A Motor Inbd Bearing Temperature			4-20 MA
Motor	AI	TE-685	ID Fan 1A Motor Outbd Bearing Temperature			4-20 MA

Existing Hardwired Control Signal List - One (1) ID Fan Variable Frequency Drive						
Device	**Type**	**Switch**	**Description**	**Power Source**	**Point Name**	**Signal**
Motor	AI	TE-986	ID Fan 1A Motor Winding Temperature			4-20 MA
Motor	AI	TE-942	ID Fan 1A Motor Winding Temperature			4-20 MA
Motor	AI	TE-980	ID Fan 1A Motor Outbd Bearing Temperature			4-20 MA
Motor	DI	TS-603	XFMR 1A1 Temp HI-HI	ID Fan 1A Remote I/O Power	10179	120 VAC
Motor	DI	TS-602	XFMR 1A1 Temp HI-HI	ID Fan 1A Remote I/O Power	10179	120 VAC
Motor	DI	TS-604	1A2 XFMR HI-HI	ID Fan 1A Remote I/O Power	10180	120 VAC
Motor	DI	TS-601	XFMR 1A1 Temp HI-HI	I/D Fan 1A Remote I/O Power	10179	120 VAC
Motor	DI	PS-426	ID Fan 1A Motor Air Filter Diff Press HI	ID Fan 1A Remote I/O Power	10178	120 VAC
Motor	DI	TS-606	1A2 XFMR HI-HI	ID Fan 1A Remote I/O Power	10180	120 VAC
Motor	DI	TS-605	1A2 XFMR HI-HI	ID Fan 1A Remote I/O Power	10180	120 VAC
VSD	DI		ID Fan Variable Speed Drive 1A2 Fdr Brkr Closed		10129	
VSD	DI		ID Fan Variable Speed Drive 1A2 Contactor	ID Fan 1A Remote I/O Power	10232	120 VAC
VSD	DI		ID Fan Variable Speed Drive 1A1 Turning Gear Speed	ID Fan 1A Remote I/O Power	10225	120 VAC

IP7_024727

Existing Hardwired Control Signal List - One (1) ID Fan Variable Frequency Drive						
Device	**Type**	**Switch**	**Description**	**Power Source**	**Point Name**	**Signal**
VSD	DI		ID Fan Variable Speed Drive 1A2 Fdr Brkr Closed		10130	
VSD	DI		ID Fan Variable Speed Drive 1A1 Contactor	ID Fan 1A Remote I/O Power	10244	120 VAC
VSD	DI		ID Fan Variable Speed Drive 1A1 Zero Speed	ID Fan 1A Remote I/O Power	10227	120 VAC
VSD	DI		ID Fan Variable Speed Drive 1A2 Min Speed 150 RPM	ID Fan 1A Remote I/O Power	10226	120 VAC
VSD	DI		ID Fan Variable Speed Drive 1A1 Fan Control Run			
VSD	DI		ID Fan Variable Speed Drive 1A2 Zero Speed	ID Fan 1A Remote I/O Power	10227	120 VAC
VSD	DI		ID Fan Variable Speed Drive 1A2 Trouble	ID Fan 1A Remote I/O Power	10228	120 VAC
VSD	DI		ID Fan Variable Speed Drive 1A2 Fdr Brkr Open		10134	
VSD	DI		ID Fan Variable Speed Drive 1A2 Trngr Spd Command		10131	
VSD	DI		ID Fan Variable Speed Drive 1A2 Norm Sp Command		10132	

IP7_024728

Existing Hardwired Control Signal List - One (1) ID Fan Variable Frequency Drive						
Device	**Type**	**Switch**	**Description**	**Power Source**	**Point Name**	**Signal**
VSD	DI		ID Fan Variable Speed Drive 1A2 Turning Gear Speed	ID Fan 1A Remote I/O Power	10225	120 VAC
VSD	DI		ID Fan Variable Speed Drive 1A2 Ready	ID Fan 1A Remote I/O Power	10231	120 VAC
VSD	DI		ID Fan Variable Speed 1A1 Drive Ready	ID Fan 1A Remote I/O Power	10243	120 VAC
VSD	DI		ID Fan Variable Speed Drive 1A1 Reference Failure			
VSD	DI		ID Fan Variable Speed Drive 1A1 Trouble	ID Fan 1A Remote I/O Power	10229	120 VAC
VSD	DI		ID Fan Variable Speed Drive 1A1 Fan Control Off			
VSD	DI		ID Fan Variable Speed Drive 1A1 Min Speed 150 RPM	ID Fan 1A Remote I/O Power	10226	120 VAC
VSD	DO		ID Fan Variable Speed Drive 1A1 Norm Sp Command		00344	
VSD	DO		ID Fan Variable Speed Drive 1A1 Fdr Breaker Open		00345	
VSD	DO		ID Fan Variable Speed Drive 1A1 Fdr Breaker Closed		00341	

IP7_024729

Existing Hardwired Control Signal List - One (1) ID Fan Variable Frequency Drive						
Device	**Type**	**Switch**	**Description**	**Power Source**	**Point Name**	**Signal**
VSD	DO		ID Fan Variable Speed Drive 1A1 Trngr Sp Command		00343	
VSD	DO		ID Fan Variable Speed Drive 1A1 Breaker Closed		00346	
VSD	DO		ID Fan Variable Speed Drive 1A1 Run Command		00347	
VSD	DO		ID Fan Variable Speed Drive 1A1 Off Command		00342	
VSD	DI		ID Fan Variable Speed Drive 1A1 Regenerative Braking			
VSD	AI		ID Fan Variable Speed Drive 1A1 Speed Control Signal			
VSD	DO		Miscellaneous Alarms 1A1			
VSD	DI		ID Fan Variable Speed Drive 1A2 Regenerative Braking			
VSD	AI		ID Fan Variable Speed Drive 1A2 Speed Control Signal			
VSD	DO		Miscellaneous Alarms 1A2			

PART F - DIVISION F8

VFD ISOLATION TRANSFORMERS

1. General: The transformers for the VFD input shall be manufacturers' standard and furnished as specified in this Division. Each transformer shall be suitable for continuous operation at 100 percent of nameplate rating, with normal life expectancy, based on the specified ambient conditions.

   This Division describes the features of acceptable transformers. The bidder shall provide detailed information on what is being offered.

2. Input Isolation Transformer: Each VFD system shall use a drive isolation transformer to provide common mode voltage protection and phase shifting (for 24 pulse or higher converter bridge, if employed to meet the power quality requirements of Division F7).

   Transformer design shall be a rectifier grade isolation-type with a K Factor of 12 for variable torque loads or a K Factor of 20 for constant torque loads when applied to a SCR converter, in accordance with current EPRI recommendations and ANSI/IEEE Standard C57.110. A K Factor of 6 is required for diode rectifier converters. Transformers shall have a BIL rating in accordance with the requirements of ANSI/IEEE Standard C57.12.01.

   Dry-type construction transformers shall be AA rated to base capacity of the VFD and provided with provisions for a fan-cooled system. If a FA transformer is supplied it shall be provided with one (1) redundant fan.

   Transformer shall be supplied with electrostatic shield, electronic temperature monitoring with alarm and trip contact, auxiliary terminal box, distribution class surge arresters, and vibration dampers.

3. Dry-Type Transformers: The insulating materials used shall be suitable for operations at a temperature of 220° C with a temperature rise limited to 115° C for conventional dry-type transformers.

   The windings shall be sealed and protected using a Vacuum Pressure Impregnation (VPI) or encapsulation process. The preheated windings shall be subjected to a dry vacuum cycle, followed by a wet vacuum cycle during which time the windings are impregnated with an electrical grade varnish resin, polyester resin, or silicone resin. A pressure cycle shall then force the resin throughout the insulation. The windings shall then be cured to bind the resin to the insulation material, while eliminating voids which could create hot spots, partial discharge, or cause corona formation. This process shall completely seal and protect the windings from moisture, dust, dirt, salt air, and other industrial contaminants.

4. Mechanical Construction: All transformer enclosures, incoming sections, and outgoing sections shall have completely enclosed sheet metal bottoms. All side panels shall be removable. The ventilated enclosure shall be of heavy gauge sheet steel, and be suitable for outdoor or indoor operation.

   Each transformer enclosure shall be gasketed and shall be provided with tops and shields required to prevent falling or dripping water from entering the enclosure. Each transformer enclosure, both interior and exterior shall be thoroughly cleaned, then given a rust-resisting primer coat and two (2) or more finish coats of enamel. The Proposal shall include a complete description of the paint system.

   External lifting eyes, or other means acceptable to IPSC for handling of the complete transformer assembly, shall be furnished as part of each enclosure framework so during movement of the unit its core and coils remain completely protected from damage or shifting.

   The unit(s) shall also be constructed and supported so movement in any direction on rollers will not damage or permanently distort the enclosure, frame, or internal apparatus.

5. Core and Coil Assembly: The core and coil assembly shall be adequately braced to withstand short-circuit forces without damage or displacement, limited only by the transformer impedance. The assembly shall also withstand normal moving and handling without the use of special shipping braces. Verification that short-circuit withstand tests have been performed on a prototype or identical transformer design shall be submitted.

   The core and coil assembly shall rest on vibration dampers designed to isolate core vibration from the enclosure.

   The core shall be constructed of high-grade grain oriented silicon steel.

   Standard values of impedance shall be used, unless otherwise required for the VFD system.

   The basic impulse insulation level shall be inherent to the design, and is to be obtained without the use of supplemental surge arresters.

6. De-Energized Taps: The high-voltage winding shall have four (4) approximately 2-1/2 percent rated full capacity de-energized taps, two (2) above and two (2) below rated primary voltage. A different tap setting is acceptable, if required, for the VFD system. The tap connections shall be bolted, flexible jumper, or rigid bar-type, easily accessible

by removal of one (1) of the enclosure side panels. The tap position indicator and terminal markings shall be clearly visible and identical with those used on the transformer nameplate.

7. Forced Cooling: If a forced cooled rating is specified in the Technical Data, Article 15 of this Division, the transformer shall be furnished with a complete forced air cooling system, including cooling fans, fan support brackets, winding temperature controls, fan power supply transformers, circuit protective devices, wiring, terminal blocks, and control panel. The fan power supply transformers shall be factory wired to the low voltage side of the transformer. All current carrying parts shall be sized for the maximum FA rating.

8. Accessories: Each transformer shall be furnished with the manufacturer's standard accessories including the following:

   a. Two (2) grounding pads.

   b. Stainless steel diagrammatic nameplate.

   c. Provisions for lifting and jacking, mounted on the transformer enclosure.

   d. Digital winding temperature indicator.

   Two (2) sets of SPDT alarm contacts and one (1) SPDT trip contact shall be furnished on the digital winding temperature indicator. All contacts shall be wired to identified terminal points in the control compartment.

   All accessories shall be clearly identified and described in the Proposal.

9. Termination Compartments: Each transformer shall include HV and LV termination compartments if the transformers are not an integral part of the VFD lineup, in accordance with the following:

   a. HV Compartments: HV termination compartments shall be of the type specified in this Division and in accordance with the following paragraphs:

      (1) The compartments shall be metal-enclosed air insulated terminal chambers with gasketed and bolted covers.

      (2) The compartments shall be large enough to accommodate working space for field installation of stress cones on HV cables that are shielded and to house other accessories specified, such as surge arresters.

(3) Enclosures shall be fabricated of electro-galvanized sheet steel or aluminum and painted in accordance with these Specifications.

(4) Indoor enclosures shall be dust-tight and impervious to dripping or falling water. Hardware shall be stainless steel or cadmium plated steel.

(5) All exterior hardware for units located outdoors shall be stainless steel.

b. LV Compartments: LV termination compartments shall be of the type specified in this Division and in accordance with the following:

(1) The compartments shall be metal enclosed air insulated terminal chambers with gasketed and bolted covers.

(2) Enclosures shall be fabricated of electro-galvanized sheet steel or aluminum and painted in accordance with these Specifications.

(3) Indoor enclosures shall be dust tight and impervious to dripping or falling water. Hardware shall be stainless steel or cadmium plated steel.

(4) All exterior hardware for units located outdoors shall be stainless steel.

(5) Terminal compartments shall be one of the following:

(a) Terminal compartments being provided that are "throat" connected to LV equipment shall be designed to connect directly to the specified equipment to form a complete assembly. All required hardware, bus splice plates, flexible connectors, etc., shall be provided.

(b) Terminal compartments being provided that are connected to LV bus duct shall be designed to connect directly to the specified bus duct to form a complete assembly. All required flanges, gaskets, hardware, bus splice plates, flexible connectors, etc., shall be provided.

(c) Terminal compartments being provided that are connected to LV cables shall be designed to accommodate field installation of the size and number of cables specified from the direction indicated in this Division.

10. Factory Testing: Each transformer shall be completely assembled and tested at the factory in accordance with applicable standards and the manufacturer's standard practices, using materials and equipment that will be a part of the final assembled unit and receive the routine and design tests as indicated by the latest revision of the applicable standard. Certified test reports shall be supplied, summarizing the results of all tests. In particular, the calculated hottest spot temperature rises of the primary and secondary windings shall be shown.

    Hottest spot temperature rises shall conform to the appropriate standard and shall be calculated using mathematical models verified by thermal tests on test windings and/or a prototype transformer representative of the design family. Tests shall have been conducted at conditions of full load or conditions simulating full load. Complete data shall be available for IPSC's review.

    IPSC reserves the right to witness factory testing and shall be informed in writing at least ten (10) calendar days prior to the scheduled starting date of tests so that arrangements can be made for a representative to be present.

11. Scope of Supply: Input isolation transformers shall be provided for configurations in which existing transformers are not suitable. These are not required on drives which include integral input transformers.

12. Schedule of Contract Submittals:

Submittal Item Activity	**To Be Received No Later Than ... Days After Award of Contract**
Outline Drawings	15
Schematic and Wiring Diagrams	30
Nameplate Drawings	15
Design Data and Performance Curves	15
Certified Test Reports	15 Days After Tests Are Completed

13. Performance and Design Technical Requirements:

Performance and Design Technical Requirements	
Transformer Name	VFD Input Transformer
Transformer-Type	Dry
ID Number	1CCE-XF-1A1 1CCE-XF-1B1 1CCE-XF-1C1 1CCE-XF-1D1 1CCE-XF-1A2 1CCE-XF-1B2 1CCE-XF-1C2 1CCE-XF-1D2
Quantity	1 Each
Standard	ANSI/IEEE C57
Self-Cooled Rating Capacity	As Required kVA
Force-Cooled Rating Capacity	Provisions kVA
Primary Voltage	6,900 Volts
Secondary Voltage	As Required Volts
Primary Insulation	45 kV BIL
Secondary Insulation	Full kV BIL
Primary Winding	Wye
Secondary Winding	Wye-Grounded/Delta
Primary Termination Compartment	Yes
Secondary Termination Compartment	Yes
Frequency	60 Hz
Number of Phases	3
Average Winding Rise	115°C
Cooling Class	FA or OA/AA

Performance and Design Technical Requirements	
Enclosure-Type	NEMA 1
Vector Relationship	24 Pulse
HV De-Energized Taps	± 2 X 2.5%
Sound Level	75 dBA
IPP Job Site Altitude	4,700 ft
Impedance	As Required %Z at Self-Cooled Rating
Maximum Ambient Temperature	50°C
Maximum Monthly Average Ambient Temperature	30°C
Average Annual Ambient Temperature	20°C
Maximum 24 Hour Average Ambient Temperature	40°C
Conductor Material	Copper
Paint System and Color	Manufacturer's Standard
Auxiliary AC Power Supply	120 Volt
K-Rating for Non-Sinusoidal Loads	As Required for Service
Neutral Grounding	Solid
Unusual Operating Conditions	VFD Input
Special Accessories	Electronic Temperature Monitor
Additional Requirements	Space Heaters

14. Required Bid Submittals:

a. Submittal description.

b. Complete description of proposed transformer.

c. Preliminary outline drawings showing estimated weights, dimensions, and locations of major accessories.

d. Summary description of codes and standards used if different than specified, including a review of major differences.

e. Price list of recommended spare parts.

f. List of special and maintenance tools to be furnished.

g. Bidder experience record with proposed equipment.

h. List of factory routine tests.

i. Complete description of the extent of shop assembly of components.

15. Technical Data:

Technical Data		
Manufacturer		
Factory Location		
Quantity		
Class and Type of Core		
Phase		
Type (Dry, etc.)		
Conductor Material of Each Winding		
kVA, Self-Cooled		kVA
kVA, Force-Cooled (Top Rating)		kVA
High-Voltage Winding		kV
kV BIL		kV BIL
Delta or Wye		
Taps		

Technical Data					
Low Voltage Winding					c'
kV BIL					kV BIL
Delta or Wye					
Taps					
Average Winding Rise-HV					°C
Insulation System Maximum Temperature-HV					°C
Insulation System Maximum Temperature-LV					°C
Cooling Class					
Frequency					
Enclosure-Type					Hz
Impedance					%Z
Vector Group					
Maximum Sound Level					dBA
No-Load Losses					kW
Load Losses					kW
Fan Losses					kW
Efficiency at Unity Power Factor					
At Full Load					
At 85% Load					
At 75% Load					
K-Factor Rating					
Total Weight					
Dimensions, L X W X H		X		X	

IP7_024739

Technical Data	
Efficiency at Unity Power Factor	
HV Winding Description	
LV Winding Description	
Terminal Compartment-Type	
Accessories	

IP7_024740

PART F - DIVISION F9

MEDIUM VOLTAGE INDUCTION MOTORS

1. General: This motor specification is applicable to all medium voltage, 3-phase, squirrel-cage induction electric motors.

2. Design and Construction: Motors shall be designed for use with a variable frequency drive. All motors shall be capable of continuous running duty.

   a. Nameplates: All motor nameplate data shall conform to the requirements of the standards listed in this Division. The following additional nameplate data shall be included:

      (1) Insulation system class designation.

      (2) Maximum ambient temperature for which motor is designed and temperature rise by resistance.

      (3) For motors with connections to an external lubricant recirculating system, or with an integral forced lubrication system, oil pressure and oil flow required. The existing motor and fan have an existing lube oil system. The existing motor requires 2.5 GPM at 20 PSIG per bearing. If the new motor requires more lube oil than available, a new lube oil system shall be furnished.

      (4) Type and grade of bearing lubricant, attached adjacent to lubricant filling devices.

      (5) For motors with current transformers for differential protection, connection diagram indicating motor lead terminal connections.

      (6) For motors with air filters, recommended set point for differential pressure device, attached on or near device enclosure.

      All motor nameplates and attachment pins shall be corrosion-resistant metal.

   b. Enclosures: New motors shall match critical dimensions and weight of existing motors as shown on the reference drawings. An adapter sole plate is allowed. Enclosure parts for all motors (e.g. frames, bearing brackets, terminal housings, external fan covers) shall be made of cast iron, cast steel, sheet steel, or steel plates. Aluminum enclosure parts are not acceptable.

Air filters are required and shall be removable from the outside of the motor and from the side only, not from the front or back. Replaceable-type air filters shall be furnished.

Cooling fans, when provided, shall be bi-directional to allow for continuous motor operation in either a clockwise or counterclockwise direction. Specific cases where such a fan is impractical for mechanical reasons shall be brought to the attention of IPSC.

c. Air Filter Pressure Differential Devices: A pressure differential device shall be provided at the air inlet of all motors furnished with air filters. The device shall be furnished with a snap-action sealed switch, having one (1) normally open and one (1) normally closed contact (Form C) which change state (close) on high-pressure differential. The switch shall have an adjustable set point which is accessible for calibration while the motor is in service. The initial adjustment shall be made at the motor supplier's factory. The purpose of the switch is to prevent motor excessive temperature by alarming clogged filters.

d. Insulation and Windings: All stator coils shall utilize copper conductors, shall be form-wound, and shall be insulated with mica based materials. All stator winding materials shall have a Class F (155° C) thermal classification and shall utilize a vacuum pressure impregnation (VPI) system.

Motor windings shall be furnished with a fly ash resistant coating.

e. Temperature Rise: The temperature rises at rated output shall not exceed those for a Class B thermal insulation classification.

f. Space Heaters: All motors shall have space heaters. Heaters shall be located and insulated so they do not damage motor components or finish.

Space heaters shall be sized as required to maintain the motor internal temperature above the dew point when the motor is idle. Space heaters below 1,000 watts shall be rated at 120 volts for use on a 120-volt system. Space heaters 1,000 watts and above shall be rated at 208 volts for use on a 3-phase, 208-volt system.

g. Terminal Housings: A terminal housing for power leads and a separate accessory terminal housing for accessory leads shall be furnished on all motors. The existing motor conduits shall be reused.

All terminal housings shall be externally mounted on the motor frame enclosure. Terminal housings for all motors shall be cast iron or sheet steel. Minimum

protection requirements shall be equivalent to NEMA 4 (IP 54). A Type II motor terminal box shall be furnished.

All motor leads located in the housings shall be permanently marked for ease of identification.

A separate accessory terminal housing shall be provided for space heater leads, temperature detector leads, and other similar accessory equipment leads. It shall be complete with screw-type terminal blocks for termination of such leads. Each terminal in the blocks shall be identified and marked for its respective leads. Accessory terminal housing shall be accessible from outside the motor.

When current transformers for motor differential protection are specified, the current transformers shall be mounted in the power lead terminal housing.

Motor power lead terminal housings shall be large enough to provide working space for the field fabrication of stress relief kits for shielded cable within the housing, and to contain the stress relief kits after fabrication. Type II terminal boxes shall be furnished.

Location and dimensions of terminal housings shall match the existing motor terminal box.

h. Leads: All leads, including motor power leads, space heater leads, and temperature detector leads, shall be wired into their respective terminal housings.

All motors shall have the direction of rotation marked by an arrow mounted visibly on the stator frame near the terminal housing or on the nameplate and the leads marked for phase sequence to correspond to the direction of rotation and supply voltage sequence.

When current transformers for motor differential protection are specified for single-speed motors, the motor phase leads shall be wired to the motor power lead terminal housing for connection for self-balancing current-type differential protection. Each current transformer shall encircle all power leads to the associated winding. The motor winding Wye or Delta connections shall be completed at the factory, leaving only three (3) leads, T1, T2, T3 (U, V, W), for field connection in the power lead terminal housing. The Wye or Delta connection shall be completed in a manner which will allow easy access to the end of each phase for field testing.

Cable motor leads shall utilize stranded copper conductors insulated with silicone rubber covered with a glass braid or acceptable equal.

i. Bearings: The type of bearing furnished shall be determined by the motor supplier based upon the load, speed, and thrust conditions of the driven equipment.

(1) Sliding-Type Bearings: Sleeve bearings for horizontal motors shall be oil ring lubricated-type. The bearings, end bells, and bearing housings shall be split-type when available. Air gap measurement holes or other acceptable means shall be provided in each motor end enclosure for checking air gap of sleeve bearing motors.

(2) Bearing Lubrication System: Motors shall be designed to use the existing pressurized bearing oil system.

(3) Miscellaneous Bearing Requirements: All bearing mountings shall be designed to prevent the entrance of lubricant into the motor enclosure or dirt into the bearings and shall be provided with pipes and drain plugs.

Bearings and bearing housings shall be designed to permit disassembly in the field for inspection of the bearings or removal of the rotor.

All oil-lubricated bearings shall be provided with oil level sight glasses marked for required oil level at motor running and standstill. Plastic sight windows or bottles shall be of a material not adversely affected by continuous exposure to sunlight.

Insulation shall be provided to prevent circulation of shaft current on bearings, on bearing temperature detectors, or on oil piping connections.

Bearing lubricants shall contain a corrosion inhibitor. The type and grade of lubricant shall be indicated on a nameplate attached to the motor frame or end shield adjacent to the lubricant-filling device. Contractor shall verify the existing lubrication system to ensure proper equipment startup and subsequent bearing maintenance.

j. Oil Lubrication Systems: For the existing external lubricant recirculating system, Contractor shall furnish pipe taps for oil inlet and outlet connections in addition to the internal lubricant recirculating system previously specified. The reused lubrication system shall maintain proper lubrication and cooling of the bearings over the complete speed range.

k. Rotors: All induction motors shall have squirrel-cage rotors. Rotors shall be adequately sized to avoid overheating during acceleration of the motor and driven equipment. Rotors shall be copper or copper alloy cage material. All fabricated cage rotors shall include a swaging or wedging method during the installation of rotor bars to prevent rotor bar vibration.

All motor rotating components shall be dynamically balanced after mounting on the shaft. Motor vibration shall not exceed the peak-to-peak amplitude values listed in the following table:

Synchronous Speed, rpm	Maximum Amplitude, Inches, (mm) Peak-to-Peak
999 and below	0.001 (0.025)

In addition, the magnitude of vibration values for twice the line frequency vibrations shall not exceed 0.0005 inches (0.013 mm).

The minimum clearance space required for removal of the rotor shall be indicated both in the Proposal data and on the dimensional outline drawing.

l. Shafts: All shafts shall be solid. Each shaft shall be furnished with a corrosion-resistant treatment or shall be made of a corrosion-resistant material.

The output shafts of motors furnished with sleeve bearings shall be circumscribed with permanent marks indicating the motor magnetic center and end float limits when level and running at rated speed. A permanent, identified reference point shall be indicated or attached to the bearing housing or shaft seal. The markings shall be easily identifiable for use during motor installation.

For horizontal sleeve bearing motors, the rotor end float and coupling end play shall be in accordance with NEMA requirements. The distance from the magnetic center line mark to each end float limit mark shall be not less than 37.5 percent of the total rotor end float.

m. Grounding Pads: External grounding pads shall be provided in at least two (2) locations (near mounting feet at opposite corners).

n. Torque Characteristics: Breakaway, run-up/pull-up, and pull-out/breakdown torque shall at all times be at least 10 percent higher than the load-torque of the driven machine, at minimum specified starting voltage. Load-torque characteristics are specified in Medium Voltage Variable Frequency Drives, Division F7, and as shown on the speed torque curve in Figure 3.3,

page F7-25; however, the responsibility for successful starting under the given conditions rests with the motor manufacturer.

o. Quality Control Tests and Inspections: Each motor shall be tested and inspected at the manufacturer's factory to determine that it is free from electrical or mechanical defects and to provide assurance that it meets the requirements of these Specifications. Test procedures shall be in accordance with IEEE or NEMA test procedures for 3-phase induction motors.

Copies of reports of the quality control tests and inspections for each motor shall be submitted prior to shipment of the motor from the manufacturer's factory.

The routine tests listed in NEMA shall be performed on each motor. One of the motors shall have complete test in accordance with IEEE Standard 112.

Additional tests shall be performed to determine the efficiency and power factor for each motor.

p. Drawings and Engineering Data: Motor dimensional drawings shall include the following information in addition to the requirements listed in these Specifications:

(1) Complete nameplate data.

(2) Rotor weight and motor total weight.

q. Couplings: The motor shaft shall be designed so the existing motor half coupling can be transferred to the new motor and reused. The existing coupling shall be reconditioned so the existing vibration dampening materials are replaced with new. Contractor has the option of furnishing a new coupling. If a new coupling is being proposed Contractor shall provide coupling information in the Proposal data.

r. Sole Plates: Existing sole plates shall be used; however, if an adapter plate is required, Contractor shall furnish one that can be bolted directly to the existing sole plate. Contractor shall provide adapter information as part of the Proposal.

s. Critical Speeds: Motors shall be designed to keep torsional and rotational natural frequencies of vibration at least 25 percent above, the motor rated speed ranges to avoid resonant vibration over the operating speed range of the equipment-motor unit.

t. Vibration Transducer Mounting: A vibration transducer mounting for field installation of an IPSC-furnished vibration transducer shall be provided on the

drive shaft bearing housing of the motor. The vibration transducer and monitoring equipment will be furnished under separate specifications.

3. Scope of Supply: Provide squirrel-cage induction motors for configurations in which existing motors are not suitable.

4. Scope of Erection/Construction: Motors must be constructed to replace existing motors on the existing foundation and on existing sole plates and all conduits. Contractor shall include a detailed description of Work required to mate new motor with existing fan and motor foundation. The written Work description shall be submitted for review with the motor dimensional drawings, and included in the instruction manuals. The Work description shall be of sufficient detail to provide the installing contractor with all information needed to install the new motors and modify any of the existing equipment.

5. Schedule of Contract Submittals:

Submittal Item Activity	**To Be Received No Later Than... Days After Award of Contract**
Power Factor and Efficiency Versus Percent Load Curves for Medium Voltage Motors	15
Motor Dimensional Drawings	15
Wiring Diagrams	30
Motor Nameplate Data	20
Medium Voltage Motor Rotor Removal Clearance Drawings	15
Bearing Disassembly and Reassembly Drawings	With Instruction Manual

6. Performance and Design: This motor data sheet is applicable for motors with nameplate ratings:

Driven Equipment		IPSC Tag Number		Quantity
ID Fan		1CCE-FAN-1A		1
Minimum Output Rating				
NEMA (HP)	**Service Factor**	**IEC (kW)**	**Synchronous Speed (RPM)**	**Direction of Rotation***
8,700	1.15	N/A	900**	CW/CCW

* Direction of shaft rotation shall be viewed from motor end opposite the motor output shaft and looking at the driven equipment. Contractor to coordinate direction of rotation existing ID Fan.

** Motors shall be designed to operate continuously at 1050 RPM.

Horizontal Shaft Mounting Arrangement - Horizontally Mounted Motor	
NEMA Motor	Horizontal, Single Shaft Extension
Rated Voltage (volts)/Frequency (hertz)	As Required
Maximum Ambient Temperature (°C)	50
Minimum Ambient Temperature (°C)	-35
Altitude	4,700 Feet
Efficiency, Minimum	High Percent

Motors shall be manufactured to NEMA/ANSI Standards.

a. Features: The following features shall be provided:

Feature	NEMA
Enclosure/Degree of Protection	WP II
Enclosure Openings Shall be Covered with Screens Manufactured from the Following Materials	Stainless
Air Filters	Replaceable

Feature		NEMA
No-Load Sound Produced by the Motor at one (1) Meter		80 dBA
Current Transformers		If Required
Stator Winding Temperature Devices		RTDs - 10 OHM - Copper (Two [2] per Phase per Winding)
Starting Voltage Range	Minimum **VFD** Percent	Minimum **VFD** Percent
Incoming Power Supply Cable and Terminations		Must Match Existing Cables or Cables Required to Fit Existing Conduits
Anti-Condensation Space Heaters		Space Heater Shall be Provided
Space Heaters Shall be Energized at		120 V for volt Heaters, 1,000 W and 208, 3Ø for Heaters 1,000 W and Above

b. Dollar Value: The following dollar value shall be used to evaluate motor energy losses at driven equipment maximum brake horsepower (kW) as defined on the Motor Proposal Data Sheet:

Dollars (US)/kW
$1,275

c. Horizontal Motors:

Horizontal Motors	
Sole Plates	Use Existing Sole Plates
Terminal Box Location, Viewed From Motor End Opposite the Motor Output Shaft	Match Existing
Horizontal Motor Bearing-Type	Sleeve Bearings Forced Oil Lubricated

Bearings		
Bearing Temperature Detectors Shall be Furnished	On Each Motor Sleeve Bearing	
Bearing Temperature Detectors	Type E Thermocouple	
Bearing Lubrication System	Oil Rings	
Bearing Lubrication System Cooling	Existing	
Driven Equipment Characteristics		
Driven Equipment Inertia	wk^2 - lb ft^2	388,240
Synchronous Speed Required Torque	954 rpm	
Starting Load	Fan-Dampers Closed	

7. Additional Requirements:

a. Special Requirements: Special requirements beyond the established standards have been defined for this Project.

Provided below are technical exceptions to, or deviations from, the requirements specified in the associated Technical Specifications for the equipment or service. These exceptions and deviations shall govern over the standard specifications only to the extent of the difference.

b. Codes and Standards: Work performed under these Specifications shall be done in accordance with the following codes and standards. The version that is latest adopted, published, and effective at the date of this Contract shall apply unless specifically stated otherwise. These references shall govern the Work except where the references conflict with IPSC Specifications. In cases of conflict, the latter shall govern to the extent of such difference.

Codes and Standards
NEMA MG1
ANSI C50.41
IEEE 112
IEEE 522

c. Approved Manufacturers:

For the following components, only the listed manufacturers are recognized as maintaining the level of quality or workmanship required by these Specifications. If Contractor wants to propose a non-listed manufacturer that is considered to provide an equivalent level of quality, the manufacturer must be identified and supporting testimony provided. Acceptance of the manufacturer as a substitute is at the discretion of IPSC.

Component	Approved Manufacturer
Medium Voltage Induction Motors	ABB Electric Machinery General Electric Reliance Siemens TECO - Westinghouse Motor Co. Toshiba

8. Required Bid Submittals: The following data shall be submitted for use in the evaluation of bids. The Proposal will be considered incomplete until the required submittals are received.

a. Submittal description.

b. Overall size, weight, and configuration for each motor and arrangement of accessory items.

c. Overall drawing showing center lines and major dimensions of each motor and minimum clearance space required for removal of the rotor shall be indicated on the dimensional outline drawing.

d. Efficiency versus percent load curves.

e. Power factor versus percent load curves.

f. If a new coupling is being proposed, provide coupling information, manufacturer, and type.

g. If an adapter plate is being proposed, provide adapter information, size, and dimensions.

h. Motor thermal limit curves.

9. Motor Technical Data:

Motor Technical Data			
Manufacturer			
Model Number			
Location of Manufacturer			
Design Standards (i.e., NEMA)			
Type and Application			
RPM Maximum			
Bearing Temperature Detectors			
Winding Temperature Detectors			
Insulation Class			
Driven Equipment Maximum Brake HP			
Motor Nameplate Horsepower			
Service Factor (NEMA Motors Only)			
Motor Losses When Operating at the Driven Equipment Maximum Brake HP			
Motor Bearing-Type			
Enclosure			
Starting Voltage Range			
Bearing Lubrication System			
Space Heater Rating, Watts/Voltage/Phase			
Minimum Clearance Required to Remove Rotor			
Height			
Length			
Width			

Motor Technical Data	
Minimum Clearance Required to Remove Rotor	
Weight	
Stator	
Rotor	
TOTAL	
Overall Dimensions, Including Shaft Extension	
Length	
Width	
Height	
Minimum Clearance Space Required for Rotor Removal	
List of Special Tools that will be Furnished	
Field Assembly Work Required	